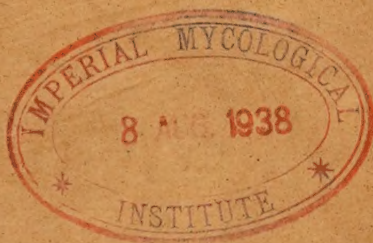


Report of the Work of The Rubber Research Board in 1937.

(Established under Ceylon Ordinance No. 10 of 1930).



March, 1938.

REPORT OF THE WORK OF THE RUBBER RESEARCH BOARD IN 1937.

(Established under Ceylon Ordinance No. 10 of 1930.)

The present report is the 7th Annual Report of the Rubber Research Scheme (Ceylon) as constituted under Ordinance No. 10 of 1930.

The provisions of the Ordinance are subject to the following amending Ordinances:—

No. 11 of 1934.—Provides that raw rubber brought into the Island for the purpose of re-export shall not be liable for payment of the cess under the Rubber Research Ordinance.

No. 35 of 1935.—Provides for transfer of the lease of Nivitigalakele to the Rubber Research Board.

No. 3 of 1936.—Provides that the Board may apply for, purchase or otherwise acquire patents, brevets d'invention, concessions and the like.

CHAIRMAN'S REPORT

Board Membership.—The 3 year period of office of the following nominated members of the Board terminated during the year and appointments to fill the vacancies were made as indicated below:—

Mr. George E. de Silva, July 13th. Re-nominated for a further period of 3 years.

Mr. I. L. Cameron, April 15th. Re-nominated for a further period of 3 years.

Mr. L. B. de Mel, April 9th. Re-nominated for a further period of 3 years.

The following additional changes in the membership of the Board occurred during the year:—

Mr. S. Phillipson acted for Mr. C. H. Collins during the latter's period of office as Acting Financial Secretary from 12th June to 13th October.

Mr. I. L. Cameron was on leave from March 17th. Mr. F. H. Layard acted for him until September 14th and Mr. R. J. Hartley from September 15th to December 1st.

Mr. E. W. Whitelaw was on leave from March 30th to 1st December and Mr. A. H. Healey was nominated to act for him.

Mr. L. M. M. Dias was away from the Island from May 18th to December 22nd and Mr. S. F. H. Perera was nominated to act for him.

Mr. C. H. Collins was on leave from 2nd November until the end of the year and Mr. C. E. Jones was deputed to act for him.

The personnel of the Board at the end of 1937 was as follows:—

Ex-Officio Members.

The Acting Director of Agriculture (E. Rodrigo, Esq., C.C.S.),
Chairman.

Representing the Financial Secretary — The Deputy Financial
Secretary (C. E. Jones, Esq., C.C.S.).

Unofficial Members of the State Council Nominated by the Governor.

George E. de Silva, Esq., M.S.C.

E. C. Villiers, Esq., M.S.C.

R. C. Kannangara, Esq., M.S.C.

Nominated by the Ceylon Estates Proprietary Association.

J. C. Kelly, Esq.,

Colonel T. Y. Wright.

Nominated by the Planters' Association of Ceylon.

F. H. Griffith, Esq., M.S.C.

B. M. Selwyn, Esq.

Nominated by the Rubber Growers' Association.

I. L. Cameron, Esq.

E. W. Whitelaw, Esq.

Nominated by the Low-Country Products Association.

Leo. B. de Mel, Esq., J.P., U.P.M.

L. M. M. Dias, Esq.

Colonel T. G. Jayewardene, V.D.

J. L. D. Peiris, Esq.

Nominated by the Governor to represent Smallholders.

F. A. Obeyesekere, Esq.

C. A. Pereira, Esq.

Meetings.—Meetings of the Board were held at Dartonfield on January 20th and at Colombo on March 16th, June 17th, July 29th and October 26th. The Board is indebted to the Ceylon Chamber of Commerce for the use of its Committee Room for meetings held at Colombo.

Committees.

Experimental Committee.—The personnel of the Committee during the year was as follows:—

- Mr. F. H. Griffith (Chairman).
- Col. T. G. Jayewardene.
- Mr. F. A. Obeyesekere.
- Mr. B. M. Selwyn.
- The Director (Convener).

Meetings of the Committee were held at Dartonfield on January 20th, April 30th, July 6th, September 28th, December 14th, and at Colombo on February 24th.

Smallholdings Committee.—The personnel of the Committee remained as follows:—

- Mr. F. A. Obeyesekere.
- Mr. C. A. Pereira.
- The Smallholdings Propaganda Officer.
- The Director (Chairman and Convener).

A meeting of the Committee was held at Colombo on August 21st.

Selection Committee.—The following Committee was appointed to advise the Board on the selection of staff officers:—

- The Chairman of the Board.
- The Chairman of the Experimental Committee.
- Col. T. G. Jayewardene.

Meetings of the Committee were held at Colombo on July 16th, October 6th, and December 9th.

London Advisory Committee.—The Board continued to contribute jointly with the Rubber Research Institute of Malaya to the cost of research on the quality of raw rubber carried out at the Imperial Institute, London, under the control of the London Advisory Committee for Rubber Research (Ceylon and Malaya). The Board's contribution during the year amounted to £875 which represents 25 per cent. of the cost of the work.

The London Advisory Committee held meetings on January 29th, April 30th, and October 1st. Meetings of the Technical Sub-Committee were held on the same dates.

FINANCE.

Income for the year amounted to Rs. 230,490-18 which was mainly derived from the cess of $\frac{1}{8}$ cent per lb. levied on exports of raw rubber under the Rubber Research Ordinance. Income from the cess was substantially higher than in 1936 owing to the increased exportable allowance under the Rubber Control Ordinance. The announcement of a substantial reduction of the export quota from January 1938, focuses attention on the difficulties experienced by the Board in framing estimates of expenditure, in face of the variations of income from year to year.

Monthly cess collections were as follows:—

			Rs.	Cts.
January	...	...	17,566	66
February	...	...	15,613	04
March	...	...	15,879	16
April	...	...	12,268	38
May	...	...	12,359	33
June	...	...	14,854	27
July	...	...	18,671	20
August	...	...	19,033	64
September	...	...	17,254	64
October	...	...	16,301	75
November	...	...	15,134	47
December	...	...	17,048	35
			<u>191,984</u>	<u>89</u>

A profit of Rs. 25,614-58 was derived from the normal working of Dartonfield estate and Rs. 6,287-37 from Nivitigalakele Experiment Station.

Current expenditure amounted to Rs. 140,924-66, leaving a surplus for the year of Rs. 89,565-52. Capital expenditure amounted to Rs. 79,570-99 including the following items:—

Part payment for Director's Smallholdings Propaganda Officer's and Secretary's Bungalows Rs. 43,802; Estate Superintendent's Office Rs. 3,272; Water and Power Scheme Rs. 3,233; Experimental Machinery Rs. 3,412; Nivitigalakele Cart Road Rs. 1,533; A sum of Rs. 1,594 was expended on agricultural development at Nivitigalakele and Rs. 1,254 at Dartonfield.

The laboratory at Culloden was demolished and the remaining staff bungalow was sold to Messrs. Rosehaugh (Ceylon) Rubber Co., Ltd. The balance sheet value of the buildings, amounting to Rs. 5,500 has been written off.

The accounts of the Scheme have been audited by the Auditor General and his report together with a balance sheet and statement of income and expenditure, are attached. The form of the balance sheet has been altered to correspond with the system of accounting adopted by the Tea Research Institute and the Coconut Research Scheme. The headings of revenue expenditure will be similarly altered in 1938.

The reports of the Director, Chemist, Botanist and Mycologist, Smallholdings Propaganda Officer, Estate Superintendent and the London Advisory Committee for Rubber Research (Ceylon and Malaya) are also attached.

E. RODRIGO,

Chairman of the Board,
Rubber Research Scheme (Ceylon).

5th March, 1938.

REPORT OF THE DIRECTOR FOR 1937.

STAFF.

Director.—The writer, Mr. T. E. H. O'Brien, was in charge of the work of the Scheme during the year. The designation of Chemist was discontinued but chemical research will be undertaken as far as circumstances permit.

Botanical Department.—Mr. R. K. S. Murray, Botanist and Mycologist, was away from the Island on leave from January 20th to November 1st and the Director was in charge of botanical work and correspondence during his absence. Mr. M. Park, Government Plant Pathologist undertook the examination of disease specimens and advisory correspondence on mycological subjects. The opportunity is taken of thanking Mr. Park for his ready assistance.

Mr. C. A. de Silva, Assistant Botanist, was on duty during the year.

Chemical Department.—Mr. M. W. Philpott, Assistant Chemist, was due to proceed on leave in October but his tour of duty was extended until April, 1938. He has accepted re-engagement for a further period of service with the designation of Chemist.

Smallholdings Department.—Mr. W. I. Pieris, Smallholdings Propaganda Officer, was away on special leave for 3 months from April 25th. The work of his Department was suspended during this period.

Estate and Experiment Station.—Mr. D. L. Nicol, Estate Superintendent, was in charge of Dartonfield and Nivitigalakele during the year.

Additional Staff.—The Board decided to enlarge the Scientific Staff by the appointment of a Geneticist and a Soil Chemist. Dr. C. E. Ford, B.Sc., Ph.D. (Lond.), has been appointed to fill the former post and is expected to arrive in Ceylon in May, 1938. The selection of a Soil Chemist has not yet been made.

BUILDINGS.

The main programme of building construction was completed, the following buildings being erected at Dartonfield during the year: Director's bungalow, Secretary's bungalow, and Estate office.

A bungalow for the Smallholdings Propaganda Officer was erected at Nivitigalakele and his office was transferred from Culloden on November 22nd. The laboratory at Culloden was demolished and the materials utilized for the estate office and minor buildings.

During 1938 one senior and one junior staff bungalow will be erected to meet the requirements of the increased staff.

A tennis court was provided at Dartonfield for the use of the senior and junior staff.

A summary of the year's work is given below and further particulars are available in the reports of the technical officers which are attached.

CHEMICAL SUBJECTS.

Vulcanized Products.—The application which was made to the Department of Labour, Industry and Commerce for a grant for the purpose of purchasing large scale machinery, was withdrawn owing to difficulty in reaching a suitable working arrangement. The Board decided, however, to undertake the semi-commercial manufacture of a few simple vulcanized products on the small experimental machinery at Dartonfield for a limited period, for the purpose of demonstrating the practicability of local manufacture of vulcanized products.

This work was undertaken during the latter half of the year but has aroused relatively little interest among potential local industrialists. It is intended that Mr. Philpott's attention will be given to subjects of greater direct interest to Rubber producers during his next period of engagement.

Nitrite Crumb Rubber.—No experimental work on the subject was undertaken locally during the year. Road trials were undertaken in England to compare the effects of nitrite crumb and latex in modifying the properties of bitumen for road surfacing. The prospects of a future demand for nitrite crumb will probably depend on the results of the trials.

Latex.—Trials of latex concentration by evaporation were undertaken in an experimental concentrator designed by the staff of the London Advisory Committee. Latex was successfully concentrated to 65 per cent D.R.C. but it was concluded that modifications in the design of the apparatus would be required for successful use under commercial conditions. Comparisons of chemical creaming agents were made and an experimental consignment of creamed latex was prepared for a London user. A Watson Laidlaw latex separator was installed for experimental work on the centrifugal concentration of latex.

An experimental consignment of concentrated vulcanized latex was prepared for a London user. It was concluded that this type of material could only be satisfactorily prepared under careful technical control.

An experiment was started to study the changes which occur in ammoniated latex during storage under tropical and temperate conditions.

Attention was given to the determination of the tensile strength of latex films. The method adopted by the staff of the London Advisory Committee gave variable results under local conditions and an alternative method will be tried when the necessary equipment is available.

Purified Rubber.—A sample of crepe rubber was prepared from latex which had been purified by triple creaming. The nitrogen content and water absorption value of the rubber were substantially lower than that of ordinary crepe but much higher than the values shown by a grade of deproteinised rubber which is available commercially. This class of rubber is finding an increasing use for cable insulation.

Brominated Rubber.—A range of brominated products was prepared from fresh latex, following the procedure used by the staff of the London Advisory Committee for studying the reaction of bromine with preserved latex. Notable differences were found in the behaviour of fresh latex and the results obtained so far are not considered promising.

Rubber Paints.—Alternative methods of incorporating oxidised rubber in paint were studied in connection with the preparation of material for painting the roofs of estate buildings at Dartonfield. A medium quality red paint suitable for exterior use is being prepared for sale at Rs. 5/- per gallon as a demonstration of the practicability of local manufacture.

Budgrafting Strip.—Rubber strips cut from Japanese made inner tubes for cycle tyres have been used extensively for budgrafting on some local estates in place of waxed or adhesive tape. A similar type of material prepared at Dartonfield was tested at Nivitigalakele and on a number of estates. The percentage of budding successes was very satisfactory and a tendency to poor ageing properties has been remedied by a suitable adjustment of the mixing. The cost of rubber strips is less than that of waxed tape provided that the strips can be used at least 3 times.

Latex Sieves.—A comparison of stainless steel, monel metal and brass gauze carried out under estate conditions showed that monel metal is at least 70 per cent more durable than brass and that stainless steel has an even longer life. It is disappointing to find that brass gauze is still used on the great majority of local estates in spite of the risk of copper contamination of the rubber, to which attention has been drawn on several occasions.

LONDON ADVISORY COMMITTEE FOR RUBBER RESEARCH (CEYLON AND MALAYA).

Close contact was maintained with the Committee's staff at the Imperial Institute and reports were received on several samples which had been forwarded for examination.

As the result of a recommendation made by the Committee arrangements have been made for investigations to be undertaken in Ceylon with a view to improving the uniformity of raw rubber. A programme of work has been drawn up in consultation with the Committee and will be taken in hand when the necessary equipment arrives.

We are greatly indebted to the Committee for their valuable assistance in the selection of a Geneticist and to the Secretary for undertaking the purchase of equipment and chemicals, and other secretarial services on our behalf.

BOTANICAL AND MYCOLOGICAL SUBJECTS.

Oidium Leaf Disease.—The severity of the disease in mid-country districts approximated to that of previous years. In some areas rain during the refoliation period interfered seriously with the control of the disease by sulphur dusting.

Little damage was caused by the disease in low-country districts owing to weather conditions being unfavourable for the spread of infection during the refoliation period. The severe defoliation of a small proportion of late wintering trees serves, however, as a reminder of the damage which may occur if conditions favourable to the fungus happen to coincide with the main refoliation period.

Root Disease.—This subject has become of increased importance during the year owing to the numerous outbreaks which have occurred in young replanted areas in which there was no previous history of disease. The source of infection can invariably be traced to an old Rubber root, indicating that the fungus was present before the trees were felled but was not sufficiently active to affect the health of the trees to a serious extent.

It is considered that it will prove less expensive to control outbreaks of disease as they occur by tracing and removing the sources of infection than to incur the expenses of complete root removal before replanting. Apart from expense the latter operation is difficult to carry out effectively in rocky areas and may lead to serious soil losses on hilly land. In areas where disease is known to be present the roots should, of course, be removed as completely as possible.

In view of the concern which the outbreaks have caused in many quarters it may be useful to remind readers that the figure of 1 per cent of losses mentioned by the Botanist and Mycologist would be regarded as extremely favourable in countries further east where considerably higher losses among the young trees are not uncommon, even in areas from which old roots have been removed before replanting.

Cockchafer Grub. *Leucopholis (Lepidiota) pinguis* Burm.—Young seedlings in nurseries and clearings on a number of estates were damaged by cockchafer grubs which breed in the soil and eat through the roots of the plants below ground level. We are indebted to the Government Entomologist, Dr. J. C. Hutson, for an article recently published in *The Quarterly Circular* describing the habits of the pest. A point of special interest mentioned in the article is that the occurrence of the grub is not connected with the

presence of decaying vegetation in the soil. On the other hand the grub of the black beetle of coconuts (*Oryctes rhinoceros*) breeds in rotting logs or other decaying vegetation but does not attack living roots.

Planting Material.—The number of local clones under test tapping at Nivitigalakele was increased to 88. Some of the younger clones are considered to show excellent promise.

Test tapping of imported clones on estates was considerably extended and valuable records are being received from various districts. An area planted with imported clones at the Iriyagama division of the Farm School and Experiment Station, Peradeniya, was brought into tapping during the year. A small area at the Department of Agriculture Farm School at Wagolla, near Kegalle, which was planted with a variety of clones in 1927-28, was handed over to the Research Scheme on lease and test-tapping was started in July. The records, in general, show that most of the imported clones can be expected to give as high yields in Ceylon as in the countries of origin. A summary of yields for the year will be published shortly in *The Quarterly Circular*.

Tapping.—The preliminary uniformity trial of an experiment laid down at Dartonfield to compare a number of tapping systems was completed early in the year and the experimental treatments were started after the annual resting period. Results of the first year's tapping will be available shortly.

A tapping experiment on an estate in the Kelani Valley district where a comparison has been made between the "double 3" A.B.C. system and normal alternate day tapping over a period of 4 years, was terminated during the year when the area was cleared for replanting. Briefly stated the results are that the double 3 system led to a reduction in crop of 11 per cent, tapping costs were reduced by 25 per cent, and there was no difference in the rate of bark renewal.

Manuring.—The manuring experiment in mature Rubber at Dartonfield was continued and the second application of fertilisers was made towards the end of the year. Yield records for the first half year were examined but, as might be expected at this stage, there was no indication of response to the treatments. It was observed that the foliage was of a better colour in the manured plots than in the control areas and that the cover of *Pueraria* had made the best growth in plots manured with phosphate.

An experiment was started in the 1935 clearing at Nivitigalakele to compare the value of compost manuring with the use of an artificial fertiliser mixture. We are indebted to the Government Chemist, Dr. A. W. R. Joachim, for undertaking the analysis of the compost.

Natural Cover.—Development of a natural cover has made slow progress in the area set aside at Dartonfield two years ago for observations on the so-called forestry system of cultivation. It is intended to manure the area in 1938.

Treatment during the year was confined to the removal of certain varieties of grass and the planting of two approved local species of plants in half the area. The plants were mostly established successfully but made poor growth.

Replanting Experiments.—A report on growth measurements in the three experimental replanted areas at Dartonfield, was issued in 3rd and 4th *Quarterly Circular* for 1937. The results are reviewed in the report of the Botanist and Mycologist and it is unnecessary to refer to them here.

The accuracy of the manurial experiment (1935 replanted area) has been seriously affected by the reduction of the number of replications of the treatment from four to three, consequent on the detection of a rogue in the Tjirandji 1 block. It has now been decided to replant the entire area and recommence the experiment in 1938, and an additional area of approximately 6 acres will be brought in to the experiment to enable the number of replications to be increased to six.

SMALLHOLDINGS DEPARTMENT.

The year was the first in which active instructional work among smallholders was undertaken. In 1936 report it was recorded that such work was to be undertaken in two areas of the Kalutara district in the first place and that instructors had been posted in these areas towards the end of the year. Work was interrupted by the absence of the Smallholdings Propaganda Officer for 3 months on special leave during which period it was found necessary to suspend the activities of his department. One instructor was found to be not quite suitable for the type of work required and his services were terminated. Instructional work was, therefore, mainly confined to one range.

Sufficient experience has been gained to show that there is a real demand among small Rubber proprietors for advice on a variety of subjects and that valuable assistance can be rendered to them by the Smallholdings Department, particularly in connection with sheet-making and replanting. The Board decided to extend the work by the appointment of 4 additional instructors who will be stationed in the neighbourhood of Avisawella, Ratnapura, Matale and Galle. These officers are now under training and will be sent to their ranges in the early part of 1938.

Activities during the year included demonstrations of sheet-making, tapping and budding, the erection of demonstration smokehouses, tests of coagulants purchased from village shops, replanting of two areas on smallholdings with budgrafts of approved clones, provision of seedling nurseries for future budding demonstrations, inauguration of competitions, participation in an agricultural show, publication of advisory leaflets. Details of the work are given in the report of the Smallholdings Propaganda Officer.

A subject of considerable importance which has received preliminary consideration is that of improving the marketing facilities for village rubber. At present the rubber is mainly purchased by local dealers at a flat rate and there is obviously little inducement to smallholders to improve the quality of their product. Dealers, who have been interviewed are not inclined to adopt a system of purchase on a graded basis according to quality unless all dealers in a particular area can be persuaded to do so, being afraid of losing custom if they pay a lower price for rubber of poor appearance. It seems clear that rubber buying must be left to private enterprise owing to the large cash turnover involved and the risks arising from day to day fluctuations in market price. It is, however, hoped to enlist the assistance of the Commissioner for Agricultural Marketing in the task of persuading dealers to adopt more discriminating methods of purchase.

DARTONFIELD ESTATE.

Crop for the year amounted to 78,020 lbs. representing a yield of approximately 600 lbs. per acre. Tapping was on the "double 4" system which has been followed since the estate was purchased in 1933 and continues to give satisfactory results.

The crop was mainly prepared as crepe or smoked sheet for sale on the local market. 2,000 gallons of ammoniated latex and 1 ton of nitrite crumb were shipped to London.

Late wintering trees were affected by oidium leaf disease and one round of sulphur dusting was carried out. There was a sharp attack of *Phytophthora* leaf-fall during the S. W. Monsoon but the loss of foliage was much less than in the previous year. A tree census showed that the number of trees affected by disease (*Brown Bast* and *Ustulina*) was slightly over 1 per cent.

Manure was applied to 50 acres of the mature area, thus completing the first cycle of the biennial manuring programme which is being followed. The spread of *Pueraria*, which was planted in 1936, was satisfactory in most areas. Vacancies in backward areas were supplied with marcotted cuttings.

An estate office and visitors' room were constructed under estate supervision. A cattle shed and staff tennis court were also constructed.

The Visiting Agent, Mr. P. R. May, visited the estate on 12th January, 25th May and 10th December and his reports were generally satisfactory.

NIVITIGALAKELE.

Approximately 1,600 trees in the 1926 and 1927 clearings were under commercial tapping. The crop from these trees was made into smoked sheet. Individual yields were recorded for a further 1,043 trees, the test

tapping biscuits being re-milled into blanket crepe at Dartonfield, after being weighed in the botanical department. The total crop was 9,000 lbs. Manures were applied in accordance with a programme of annual manuring.

Girth measurements in the older clearings were made during the year and the tabulated figures were published in *The Quarterly Circular*. It was concluded that the average rate of growth was similar to that of estate areas planted during the same period.

Budding was completed in the part of the Pinnagoda 1935 clearing planted with seed for budding in the field. The clearing was manured during the year for the first time. Girth measurements made in connection with the compost experiment referred to in the Botanist's report showed that the growth of budded stumps in the area has been slower than in replanted areas at Dartonfield.

Budding was completed in the Pinnagoda budwood multiplication area. The area cleared in 1936 for use as a seedling nursery was planted with approximately 50,000 seeds. 10,000 budded stumps and 1,600 yards of budwood were sold to estates and smallholders.

Courses of training in budgrafting were arranged for estate employees of the Conductor type, most of whom reached a good standard of proficiency. Subsequently, shorter courses were held for other persons such as unemployed youths. Some of them show promise of becoming good budders but the results were, on the whole, disappointing.

ADVISORY SERVICES.

Advisory correspondence was an important feature of the Scheme's work during the year but the number of estate visits was necessarily reduced to a minimum owing to the absence of the Botanist and Mycologist during the greater part of the year.

There was a reduction compared with last year in the number of enquiries on replanting and allied subjects but this does not indicate a diminution of interest in the subject. On the contrary, there has been a considerable extension in replanting operations but many Superintendents now have practical experience of the work. Enquiries on the manuring of mature Rubber showed an increase, more especially in regard to methods of application and the best time of year for manuring. There is very little reliable information available on either of these points at present but the opinion has been expressed on general grounds that these factors will probably prove to be comparatively unimportant in relation to the effect of the manure itself. Memoranda on various planting topics were prepared with a view to minimising the time occupied in dealing with enquiries.

The improved financial condition of the industry was reflected in the greater interest which was taken in factory equipment. Numerous copies of smokehouse plans were issued and advice given on crepe mills and

sheeting batteries, coagulating tanks, crepe drying houses, etc. There were a few enquiries regarding the prospects of present factory methods becoming obsolete but it is now more generally recognized that smoked sheet and crepe are likely to remain the standard forms of raw rubber for many years.

A Canadian rubber manufacturer complained of the presence of grit in a consignment of Ceylon rubber. The firm in question specializes in the manufacture of thin waterproof baby pants and the gritty particles caused blemishes in them. The source of the consignment could not be traced with certainty but two estates from which the rubber might have emanated, were visited and advice given on methods of improving the cleanliness of the product. The Manufacturer has been put in touch with a local Producer who is prepared to supply crepe of guaranteed cleanliness to meet his rather special requirements.

There were 153 visitors to Dartonfield during the year according to the Visitors' Book but this record is probably not quite complete. Among notable visitors were Mr. H. Kolkman, Chairman of the A.V.R.O.S.; Dr. Th. G. E. Hoedt, Director of the Proefstation West Java; Mr. Andrew Young, Chairman of the Ceylon Association in London; Mr. A. E. Grasovsky of the Palestine Government; Dr. P. J. Cramer. Visits of technical officers from other research organisations are referred to in a succeeding paragraph.

MEETINGS, COMMITTEES, ETC.

The Director was present at meetings of the Rubber Research Board by invitation and attended meetings of the Experimental Committee and other Sub-Committees of the Board.

The Director is an ex-officio member of the Central Board of Agriculture and a member of the Board for the Special Assessment of Budded Rubber. He was also nominated to serve on a Department of Agriculture Committee for the compilation of a manual on weeds.

The annual general meeting of the Planters' Association of Ceylon and general meetings of the Kalutara Planters' Association were attended.

CO-OPERATION WITH OTHER RESEARCH ORGANISATIONS.

Official visits to the Research Scheme were made by technical officers of rubber research organisations in other countries as follows:—

Dr. G. M. Kraay, Chemist, Proefstation West Java. 14th April to 21st April.

Dr. N. H. van Harpen, Chemist, Proefstation der A.V.R.O.S., 2nd September to 9th September.

Dr. J. S. Vollema, Botanist, Proefstation West Java. 9th November to 17th November.

Mr. J. Wilson, Director of Research, British Rubber Producers' Research Association. 27th November to 2nd December.

Subjects of mutual interest were discussed and visits to representative estates arranged. These visits are indicative of the general desire for close collaboration between the Research organisations in different rubber producing countries, and there is no doubt that periodical exchanges of visits are invaluable in furthering such co-operation.

Co-operation was maintained with the Rubber Research Institute of Malaya, the Rubber Growers' Association and the Rubber Producers' Research Association by the regular exchange of reports and by correspondence.

Publications were exchanged with a number of scientific organisations in different parts of the world.

PUBLICATIONS.

Arrangements for the issue of publications were revised early in the year and annual renewal of application for registration is not now necessary. Publications are available without charge to Proprietors (resident in Ceylon) Superintendents and Local Agents of Rubber estates over 10 acres in extent, who apply for registration. There are now 554 estates and agencies on the publications register.

Publications issued during the year were as follows:—

Annual Report and Accounts 1936.

Bulletin No. 54 "Report on a Visit to Malaya, Java and Sumatra" by R. K. S. Murray.

1st and 2nd Combined Quarterly Circular for 1937.

Artificial Rubber. By M. W. Philpott.

Ceylon Clones—V. By C. A. de Silva.

Notes on the Propagation of *Pueraria phaseoloides*. By C. A. de Silva

Line Sites and Hevea Nurseries — A Warning. By Malcolm Park.

Planting Notes. By T. E. H. O'Brien.

Minutes of the 36th and 37th Meetings of the Rubber Research Board.

3rd and 4th Combined Quarterly Circular for 1937.

A Note on the Grey-Back Beetle or Large Cockchafer *Leucopholis (Lepidiota) pinguis* Burm. By Dr. J. C. Hutson.

Field Experiments on Dartonfield Estate—V. Measurements of Growth in Replanted Areas. By C. A. de Silva

Notes on the Growth of Budded Trees at Nivitigalakele Experiment Station. By T. E. H. O'Brien.

Soil Erosion in Relation to Rubber Estates. By T. E. H. O'Brien.

Minutes of the 38th, 39th and 40th Meetings of the Rubber Research Board.

T. E. H. O'BRIEN,

Director,

Rubber Research Scheme (Ceylon).

Research Laboratories,

Dartonfield, Agalawatta,

15th February, 1938

REPORT OF THE CHEMIST FOR 1937.

The work of the Chemical Department during 1937 may conveniently be recorded under three headings: (1) Manufacture of vulcanised products, (2) Latex subjects, (3) Miscellaneous.

1. MANUFACTURE OF VULCANISED PRODUCTS.

In 1936 it was stated that investigations on the manufacture of vulcanised products had reached a stage at which further developments could most usefully be made by enlarging the scale of production and that a scheme to provide facilities for such work was receiving the attention of the Executive Committee of Labour, Industry and Commerce. Difficulty was, however, found in coming to a suitable working arrangement and the Rubber Research Board decided to withdraw its application for a grant for the purchase of large scale machinery but to continue to demonstrate manufacturing methods so far as this could be done with the experimental plant available at Dartonfield.

To draw public attention to this work and to the possibilities of local manufacture a small range of domestic articles was made and retailed through the Commissioner for Agricultural Marketing. A number of orders from Government Departments for rubber tubing, etc., were also fulfilled.

Several requests for detailed information on the manufacture of tyre re-treading compounds were received from tyre repairers both in Ceylon and India. In several cases small quantities of such compounds were made at Dartonfield and supplied to the re-treading concerns as a demonstration of the practicability of manufacturing the materials locally. As a result of this work one firm in Colombo is now manufacturing its own tyre re-treading materials on a small scale.

Apart from this single instance the local response to the demonstrational work on the manufacture of vulcanised goods has been disappointing.

2. LATEX SUBJECTS.

Latex Shipment.

In order to provide material for experimental work and to illustrate the recommended method of preserving latex, part of the Dartonfield crop was made into normal ammoniated latex and several commercial shipments were made during the year.

Latex Concentration.

At present the premium which unconcentrated latex commands in the market offers little incentive to the producer to give the extra care and attention which this form of manufacture involves and it is doubtless

for this reason that the preservation of latex is not yet receiving much attention in Ceylon. The shipment of concentrated latex is, however, comparatively profitable and it is believed that many estates would manufacture this grade if the processes were known to be free from patent restrictions and if the necessary knowledge and technique were locally available. With regard to patents it is perhaps not generally known that one of the main concentration patents expired in Ceylon during the year under review and that another will expire in 1938. In anticipation of this situation some attention was given to the three main methods at present available for concentrating latex, namely creaming, evaporation and centrifugation.

(a). **Concentration by Creaming.**—A small (40-gallon) creaming tank was constructed and used for preparing an experimental consignment of creamed latex for a London user.

A sample of "Konnyaku" meal, a creaming agent kindly supplied by the Director of the Proefstation West Java, was examined in the laboratory and found to be an efficient creamer but on a larger scale and under the particular conditions of the experiment it gave less satisfactory results than Tragron A. "Konnyaku" meal appeared to be more sensitive than Tragron A to the age of the latex but unlike Tragron A its effectiveness did not vary with the ammonia content of the latex.

(b). **Concentration by Evaporation.**—A small scale latex evaporator of a type designed by the staff of the London Advisory Committee was received for trial. The machine was reported to have given promising results when used in London with old latex and information was required on its suitability for concentrating fresh latex. The first experiments showed that the rate of evaporation was slower than had been experienced in London and it was concluded that to concentrate field latex by this method would be uneconomic; subsequent trials were therefore made with latex that had first been partially concentrated by creaming. The main conclusion drawn from the results of this work was that the machine would require some modification in design to make it suitable for commercial production.

(c). **Concentration by Centrifugation.**—Towards the end of the year a Watson Laidlaw latex separator was received and trials were begun early in the New Year.

Latex Vulcanisation.

The experiments which were started in 1936 in connection with the manufacture of vulcanised latex in the East led to a request from London for a 25-gallon sample of concentrated vulcanised latex. This was prepared by the following sequence of operations: (1) ammoniation of field latex; (2) vulcanisation by contact with vulcanising agents at ordinary temperature over a period of three days; (3) removal of vulcanising agents by settling;

(4) concentration by creaming. The material was packed in kerosene tins and shipped to London where it is reported to have been received in good condition. As a result of these trials the opinion was formed that in the manufacture of vulcanised latex on estates rigorous technical control would have to be exercised at each stage of production in order to eliminate the possibility of variations in the product.

Latex Storage.

The changes which take place in preserved latex during the first few days after ammoniation have already attracted the attention of investigators but the effect of prolonged storage under ordinary commercial conditions has not been studied very closely. The necessity for an investigation on this subject was suggested by the results of an examination of some normal preserved latex which had been stored for 12 months at Dartonfield.

Four batches of latex with various dry rubber and ammonia contents were prepared and sealed in kerosene tins, one half of each batch being sent to London and the rest kept at Dartonfield. The changes in dry rubber and ammonia content will be followed by examining the latex in both places at six monthly intervals. The results obtained should give useful information which is not at present available.

Latex Film Strength.

Arising out of a request for supplies of latex possessing a specially high film strength some attention was given to the question of measuring the tensile strength of raw and vulcanised latex films. In the course of a number of determinations made as far as possible under the conditions recommended by the London Advisory Committee it was found that tests made from day to day on the same samples of latex showed neither agreement nor systematic variation. Attempts to get more reliable figures by a suitable choice of testing conditions were unsuccessful and the conclusion was reached that the Schopper technique is unlikely to give results of any value under local climatic conditions. Consideration is now being given to an alternative method of measuring film strength.

3. MISCELLANEOUS SUBJECTS.

Purified Rubber.

In view of the interest which many manufacturers are now showing in rubber which has a low water absorptive capacity a batch of latex was prepared and purified by multiple creaming. Part of this latex was also coagulated with formic acid and made into blanket crepe. Analysis of the purified crepe showed that it contained 0.16 per cent of nitrogen while ordinary blanket crepe manufactured at the same time contained 0.30 per cent. Thus although a substantial proportion of the non-caoutchouc constituents had been removed, the rubber could not be classed with a type of deproteinised rubber which is being produced commercially and which

is stated to have a nitrogen content of less than 0.04 per cent. Nevertheless the experiment was instructive in showing not only that it is practicable to effect some purification by this method but that the cost of such a process would not be excessive in relation to the premium which deproteinised rubber now commands. Various ways of improving the product suggest themselves and the problem will be taken up again when opportunity permits.

Smallholders' Coagulants.

A number of samples of acid coagulant was received for examination from the Smallholdings Propaganda Officer. These were obtained in connection with an investigation which is being carried out by the Smallholdings Department on the quality and cost of coagulants which are distributed by small retailers. It is proposed that samples should be drawn from all the chief rubber growing districts of Ceylon in order that the survey may be as representative as possible. A report on the subject will not be made until all the samples have been received and examined.

Brominated Rubber.

The work of the technical staff of the London Advisory Committee on the production of halogenated derivatives of rubber preserved latex was repeated, in part, with fresh latex. The behaviour of fresh latex towards bromine was found to differ markedly from that of preserved latex and so far the results obtained have not been promising. Pressure of other work has unfortunately made it impossible to carry out any systematic laboratory experiments on this subject.

Rubber Paints.

Again considerable quantities of oxidised rubber paint were made for estate use.

Attention was given to the method of preparing the solution of oxidised rubber which is used in the preparation of these paints. The following points may be noted as being of possible interest:—

(1) There appeared to be two stages in the process of oxidation-solution of the masticated rubber in white spirit; (a) a stage in which the rubber goes into the solvent with difficulty and forms a very viscous solution and (b) a stage in which the viscosity falls very rapidly. In a typical experiment with crepe containing $2\frac{1}{2}$ per cent of cobalt linoleate the "induction period" was 7 hours and the final period 4 hours making a total of 11 hours to form a 50 per cent solution of the desired viscosity.

(2) Rubber which had been purified by triple creaming went into solution more rapidly than ordinary crepe (about 7 hours instead of 11).

(3) First grade scrap behaved in the same way as crepe.

(4) A considerable saving in time could be effected by adding the linseed oil to the rubber during mastication (but before the addition of the drier). In this way the solution was formed in 4 hours.

(5) It was found practicable to prepare the paint by adding the pigment to the rubber during mastication, and then letting down in white spirit and mixing the solution with linseed oil. This method had the advantage of giving very good pigment dispersion.

Budgrafting Strip.

A quantity of thin vulcanised rubber was made and cut into narrow strips to serve as a waterproof binding material for fixing the budpatch in position during the budgrafting operation. Trials were made in the field at Dartonfield and about a dozen estates were supplied with the material and asked to report on it. The advantages of this type of binding strip appeared to be: (1) applied under tension the strip gives very efficient protection against moisture, (2) bandaging can be done rapidly and cleanly since the material is not sticky, and (3) it should be possible to use the strip a number of times.

The material proved to be highly satisfactory from the point of view of the percentage of budding successes obtained with it but some of the first samples were reported to have had rather poor ageing qualities. This defect was remedied in the later products by a suitable alteration in composition.

Towards the end of the year arrangements were made for making budding strip by extrusion.

Latex Sieves.

The use of brass gauze on estates for straining latex is still almost universal. It may be recorded that in the course of a short tour in which the writer visited twelve factories it was found that only one estate had adopted the Research Scheme's recommendation not to use brass latex sieves.

In order to obtain information on the durability of various metal gauzes, brass, monel metal and stainless steel strainers were used under observation at the factory at Dartonfield. The indications obtained so far are that monel metal gauze has a useful life which exceeds that of brass by at least 70 per cent and that stainless steel is apparently even more durable.

Brass in latex utensils is undoubtedly a possible source of copper contamination and rubber manufacturers have expressed the wish that estates should reduce this risk of contamination by avoiding the use of brass gauze for latex sieves. The cost of meeting the manufacturers' wishes in this regard has already been shown (Research Scheme *Quarterly Circular*, December 1935, p. 110) to be very small and it is now estimated that if the longer life of a monel metal strainer is taken into account the additional

cost incurred by using this material instead of brass is, at the most, one-hundredth of a cent per pound of rubber. There seems, therefore, to be no justification for the continued use of brass and it is hoped that the matter will receive the attention of local estate managers and proprietors.

METEOROLOGICAL OBSERVATIONS.

The summary of the weather records for the year 1937 is as follows :—

Rainfall	...	...	180.52 inches
Highest monthly rainfall	...	36.34	,, (May)
Highest daily rainfall	...	4.93	,, (April 3rd)
Highest shade temperature (day)	...	95.0	(Feb. 16th)
Lowest temperature (night)	...	57.5	(Dec. 8th)
Number of rainy days	...	219	

PUBLICATION.

The following article was published in the 1st and 2nd *Quarterly Circular* for 1937 :—

“Artificial Rubber.”

M. W. PHILPOTT,

Chemist.

Research Laboratories,
Dartonfield, Agalawatta,
2nd February, 1938.

REPORT OF BOTANIST AND MYCOLOGIST FOR 1937.

In contrast to previous years, when each officer has submitted a separate report, the procedure now adopted is to present what may be termed a "divisional" report *i.e.*, to cover all work on Botanical and Mycological subjects.

Staff.—Mr. R. K. S. Murray, Botanist and Mycologist, was absent on furlough from the 20th January to the 1st November. During his absence advisory work on botanical and general planting subjects was in the hands of the Director, while disease specimens and mycological enquiries which could not readily be dealt with here were referred to the Government Plant Pathologist. Thanks are due to Mr. M. Park for his valued assistance and co-operation.

Mr. C. A. de Silva, Assistant Botanist, was mainly engaged in the supervision of the field experiments at Dartonfield and Nivitigalakele, all growth measurements in connection with these experiments being made by him personally. He has also been responsible for the statistical analyses of the results, and for sundry minor investigations.

I. MYCOLOGICAL WORK.

1. *Oidium* Leaf Disease.

In the writer's absence no experimental or demonstrational work in connection with *Oidium* was undertaken. Likewise there was no detailed study of the incidence of the disease in various localities, and the following brief review is based on the Director's observations in the Kalutara District supplemented by notes received from Estate Superintendents elsewhere.

In the low-country wintering was late, and the weather during the time when most of the young leaf was forming was hot and dry and therefore unfavourable to the activities of the fungus. Consequently the attack was mild. The latest wintering trees, however, suffered severe defoliation where sulphur dusting was not carried out, though a study of meteorological records at Dartonfield does not reveal any marked changes to which this increased incidence could be attributed. It would appear that in a normal year, when the weather in February and March is hot and dry, it takes some weeks for the fungus to emerge from its inactive phase and multiply itself sufficiently to cause extensive infection. Thus it is only the later wintering trees which lose much leaf. Exceptionally, however, as in 1934, when the weather during refoilation was wetter and more cloudy than usual, the fungus assumes an important rôle at an earlier stage.

At the higher elevations *Oidium* was as prevalent as in former years, and in some districts the sulphur dusting operations were seriously interfered with by rain.

2. Root Disease.

The subject of root disease has recently become prominent owing to the number of outbreaks that have occurred in replanted clearings. During 1937 numerous specimens were received of plants from one year old upwards which had become infected in areas supposed to be free from root disease as judged by the history of the former stand. The fungi concerned were usually *Fomes lignosus* or *Poria hypobrunnea*. Attention was drawn to this apparently paradoxical phenomenon in the Mycologist's Report for 1933, where the theory was advanced that *Fomes* could remain underground in a dormant condition for many years, being re-invigorated to a state of active parasitism by the cultural operations associated with replanting. Recent experience indicates that this explanation is substantially correct, and that the age and general condition of the host plant are probably factors of importance. In every investigated case, whether in our own clearings on Dartonfield or on estates, it has been possible to trace the source of infection to an old Rubber root, thus proving that the fungus must have been present before the old trees were removed but was not doing sufficient damage to give any visible indication of its presence above ground. It was probably present in the wood of the root system in a state of what may be termed "subdued parasitism." When an infected tree is felled and the roots left in the ground the balance between fungus and host is upset, and the former assumes a condition of active growth. It then only needs the contact of a young root with the old infected root for the fungus to spread to the new plant and kill it.

The status of *Poria* as a root parasite is interesting as this fungus is very uncommon as a cause of root disease in old Rubber. Its prevalence in new clearings suggests that young plants are much more susceptible to attack than mature trees.

The unpredictable incidence of root disease in replanted clearings leads to the consideration of measures that could be adopted to eradicate the causative fungi. The most obvious measure is to regard all roots of the old trees as suspect and remove them. This would doubtless be effective but it is also an expensive and often impracticable proceeding. The minimum figure for which any useful root removal can be carried out is about Rs. 10 per acre, and one would have to be satisfied that the extent of damage caused by root disease would otherwise amount to this sum for its expenditure to be justified. The word "unpredictable" has been used in this connection because the incidence of disease, as judged by the number of plants lost, has been found to vary from almost nil up to over 1 per cent. in areas with a similar past history. In the case of quite recent clearings the story, of course, is not fully told, but it may at present be said that in the majority of cases it would appear improbable that the loss of plants and expenditure on control measures will be found

to justify the cost of initial root removal. It should be emphasised that these remarks apply only to areas which are supposedly free from root disease at the time of felling.

A further suggestion has been propounded that an attempt should be made to discover the "knots" of infection at an early stage by planting upright leguminous green manures to act as "indicators." If suitable species are chosen these plants will succumb quickly to root infection and will thus indicate the presence of parasitic fungi. Without calling into question the efficacy of this procedure or its value in special circumstances, the view is here expressed that inasmuch as it involves departures from orthodox agricultural measures *e.g.*, creeping covers cannot be grown and the bushes cannot be lopped, it is not to be recommended except perhaps in areas where root disease is a factor of paramount importance. It is considered that the young Rubber tree itself will act as an indicator and reveal the presence of any sources of infection within the first three or four years. A small proportion of the plants will be lost, but this is of little consequence if the initial planting density is considerably higher than the final stand aimed at. It may be found desirable to institute a periodical inspection of the root systems of all young plants for the first two or three years with the object of detecting the presence of the fungus before it has become evident from aerial symptoms.

The views expressed above do not by any means constitute a final judgment. The subject of root disease in relation to replanting requires thorough investigation, and it is hoped that the additions to be made to the Staff in 1938 will render such work possible.

3. Cockchafer Pest.

The large amount of replanting now being undertaken has brought into prominence the grub of a cockchafer beetle *Leucopholis (Lepidiota) pinguis* as a pest of young Rubber seedlings in nurseries and clearings. Although the number of estates on which the pest has been recorded is not large, in individual instances the damage has been fairly extensive. It is during the first few months after planting that the seedlings are most susceptible to attack.

Control measures have hitherto consisted mainly of removing and destroying the grubs that have killed young Hevea plants. The Assistant Botanist has carried out preliminary trials with sulphur and three proprietary soil fumigants to determine in the first place whether their application is harmful to young seedlings. It was found that sulphur and one of these preparations could be safely applied at the rate of 4 oz. per square yard, and every opportunity will be taken to test their efficacy in killing the grubs.

Dr. J. C. Hutson, Government Entomologist, contributed some notes on the life-history of the cockchafer beetle in the combined 3rd and 4th *Quarterly Circular* for 1937, and points out that whereas the rhinoceros or black beetle of coconuts breeds in decaying Rubber stumps and logs (and is therefore a danger to coconut palms in the vicinity), it is very unlikely that *Lepidiota* grubs will do so.

II. BOTANICAL WORK.

The Improvement of Planting Material.

A. Budgrafting.

1. *Studies on Clones.*

(a) *Ceylon Clones.*—Test tapping of Ceylon clones has been continued at Nivitigalakele and on various estates co-operating with the Scheme, the rubber being sent to these laboratories for weighing. 12 new clones were brought into tapping at Nivitigalakele in April, bringing the total number being tapped on the Station to 88.

In addition to the test tapping, whereby the yield of each individual tree is recorded, the clones in the 1926 and 1927 clearings are also being tapped commercially. The latex from each clone is collected and measured separately, and from a determination of the dry rubber content the yield of rubber is calculated.

The yields of the older clones in the 1926 and 1927 clearings continue to be rather disappointing. Several clones have reached a level of about 9 lbs. per tree in the 9th or 10th year of age, but this compares unfavourably with imported clones of proved high yield. On the other hand some of the younger clones in the 1928 clearings give excellent promise, and there are several which are giving substantially higher yields than Prang Besar 23 and 25 which were planted to serve as a standard of comparison. The results from the more interesting clones for 1937 will be published in *The Quarterly Circular* in 1938.

(b) *Imported Clones.*—The test tapping of imported clones on estates has been much extended during the year, and valuable records are now being received from a number of sources in different districts. In a few instances budgrafts of imported clones are being commercially tapped, but the general tendency is to leave such material untapped while the restricted crop can be obtained from mature areas. In general the results are excellent and indicate that most of the imported clones will give as high yields in Ceylon as in the several countries of origin. Representative figures will be published in *The Quarterly Circular*. Among other sources of such records may be mentioned the Department of Agriculture Farm School, Wagolla, Kegalle, on which a number of interesting imported clones were established in 1927-28. One of the experimental tappers from Nivitigalakele has been sent to tap these trees and the rubber is weighed at Dartonfield.

2. *Distribution of Material.*

10,137 budded stumps and 1,632 yards of budwood of imported clones were sold to estates and smallholders during 1937. Applications for 1938 delivery were received and allocations made towards the end of the year. The work of dealing with these applications and organising the delivery of the material takes up a considerable amount of a Research Officer's time.

B. Selection and Breeding.

No progress can be recorded along these lines owing to the limited staff on duty during the greater part of the year. With the appointment of a Geneticist in 1938 it will be possible to recommence work on a sound footing.

Problems Connected with Mature Areas.

A. Tapping.

The preliminary year's uniformity trial in the areas allocated to the tapping experiment on Dartonfield was concluded in February and the experimental treatments commenced in March after the annual rest. The figures for the first complete year are not available for presentation in this report but will be published in due course.

The results of the uniformity trial gave a standard error of 13.85 per cent. of the mean plot value. This is a relatively high figure, indicating considerable variation amongst the individual plots, and is to be expected in view of the small size of the plots (30 trees) and the heterogeneous nature of the material. It is in close agreement with the corresponding figure of 13.05 per cent. for the uniformity trial preceding the manuring experiment. The random arrangement of the 11 hypothetical treatments in the six blocks has, however, resulted in the treatment means being relatively uniform, so that all the treatments are given a fairly level start. It is, of course, the main purpose of the uniformity trial to provide a means whereby the results can be compensated for any initial inequalities.

In the Annual Report for 1935 (page 40) the results were given of experiments on two estates to compare the double-three A.B.C. system of tapping with alternate day tapping on a single half spiral cut. On estate A the experiment was stopped in 1935 and there is no further information to be given, but on estate B the experiment was continued until February, 1937, and the results are summarised below.

Yield.—Over the four years' duration of the experiment the double-three system has resulted in a loss in crop of 11 per cent. The figures for the four years are given in Table III.

TABLE III

Tapping System	Yields in lbs. per acre for periods (figures in brackets represent percentage of A.D.)				
	1933-34	1934-35	1935-36	1936-37	Mean 1933-37
$\frac{1}{2}$ SP. A. D.	431 (100)	408 (100)	454 (100)	340 (100)	408 (100)
D/3 A.B.C.	365 (84.3)	411 (100.8)	376 (82.7)	303 (89.2)	363 (89.0)

Tapping Costs.—Despite this loss in crop there is a saving in tapping costs of about 25 per cent., the ratio of the sizes of the tapping tasks being D/3 : A.D. = 2 : 3.

Rubber Contents.—Except for the first year the rubber content of the latex has been consistently higher on the double-three than on the alternate day system, the mean figures for the whole four years being 3.38 and 3.11 lbs. per gallon respectively.

Bark Renewal.—Measurements made at all heights showed no significant difference between the average rates of bark renewal under the two systems.

Bark Consumption.—The average rates of bark consumption were:—

Double-three	...	...	5.5 ins. per annum
Alternate day	...	...	5.75 „ „ „

It is possible that the double-three consumption should have been greater for the system to attain what may be termed its true yield.

It would appear that under the conditions of the experiment *i.e.*, fully mature trees of moderate yielding capacity in a wet district, the double-three system is in no way harmful to the trees and its adoption might be justified when a full crop is not required or when cheap tapping is of primary importance.

B. Manuring.

Practical problems connected with the application of artificial fertilisers to mature trees have been the subject of many enquiries received from estates, the two commonest questions being: (1) At what time of the year should fertilisers be applied? (2) Should the land be forked or the manure broadcast? In reply to such questions it has to be admitted that critical data on which opinions can be expressed are almost entirely lacking. It would seem, however, that although there is doubtless an optimum time and mode in any given set of conditions, these matters are likely to be of relatively small importance in relation to the effect of the manure itself. Forking is considered to be unnecessary for incorporating soluble fertilisers in the soil, and although it may be desirable to fork land that has not been cultivated for some years repeated disturbance of the same area is not recommended. The experiment on Dartonfield, to which reference is made below, will provide information on this point.

The second year of the manuring experiment on mature Rubber was completed at the end of 1937. It will be recalled that in 1936 the yields were recorded as a preliminary uniformity trial, the first application of manures being made in December of that year. Thus 1937 was the first year after the initial fertiliser applications. The results for the full year are not available for inclusion in this report, but it may be mentioned that an analysis of the yields for the first six months showed no response to the treatment. During the course of making the second applications in December, 1937, it was noticed, however, that the foliage of the manured plots was in all cases a better colour than that of the controls, and that the ground cover of *Pueraria phaseoloides* had made best progress in the

plots with phosphate *i.e.*, NP and NPK. These early observations are all entirely in accordance with expectations.

The analysis of the uniformity trial gave a figure of 13.05 per cent. as the standard error expressed as a percentage of the mean. The random arrangement of the treatments has proved to be somewhat unfortunate as the plots allotted to the control gave the lowest yield while those for the complete fertiliser gave the highest. This experience emphasises the importance of a uniformity trial when working with small plots, for by employing a regression on these preliminary yields it will be possible to compensate for the initial differences.

Early in March measurements were made of the girth of each tree at a height of 4 feet from the ground and of the height of the tapping cut. The means together with the yields of the hypothetical treatments are given in Table IV. It will be noted that both the height of the tapping cut and the girth even out for the different treatments.

TABLE IV

Hypothetical treatments	Average yield per plot (20 trees in 1936)	Height of tapping cut.	Girth.
N	117.5 lbs.	15.3 ins.	35.8 ins.
NP	115.1 „	15.0 „	37.3 „
NK	122.1 „	16.8 „	39.2 „
NPK	124.3 „	17.8 „	37.1 „
Control	103.4 „	15.0 „	33.8 „
Mean	116.4 „	16.0 „	36.6 „

The experiment on the fertiliser requirements of young buddings on replanted land is referred to below under the heading Replanting.

An experiment to compare the value of compost with artificial manure was started in the Pinnagoda clearing at Nivitigalakele. The compost was obtained from the Kalutara Urban District Council and analysed by the Government Agricultural Chemist. 38 plots of two year old buddings of local clones were divided into two halves (12 trees in each half), and to one half was given the compost manure at the rate of 20 lbs. per plant while to the other was given an artificial mixture (mainly inorganic) so adjusted that the quantities of the three nutrients were equivalent for the two treatments. Preliminary girth measurements of every plant were made, and the applications will be continued annually.

C. Cover Crops.

In the Annual Report for 1936 mention was made of the trial of natural covers being carried out in a block of 20 acres on Dartonfield. During 1937 weeding was confined to the removal of certain undesirable grasses which were forming a thick mat in localised areas, and to the thinning out of the fern *Blechnum orientale* which is now confined to drains and stone terraces. In June one half of the area was planted

with *Macaranga tomentosa* (S. Kenda) and *Hedyotis fruticosa* (S. Wera-niya), both regarded as desirable species, but although most of the young plants survived the transplanting they have made very poor growth.

The plants that have made most progress during the year are the local "Rhodendrons" and *Desmodiums* and *Blechnum orientale*. Although the general cover is noticeably denser than at the end of 1936 the tempo of the process cannot be described as other than slow, and it is proposed to fork and manure this area in 1938 with a view to speeding the establishment and spread of the best types of cover.

D. Replanting.

Continued interest has been shown in replanting though the number of enquiries shows a marked fall as compared with 1936. This does not reflect diminished activity on estates but probably indicates that most Superintendents have already gained experience of the methods employed and no longer need to refer to the Scheme for detailed advice. Although most large and many small estates in the major Rubber districts are undertaking replanting programmes, the total area replanted by the end of the present period of restriction is likely to fall far short of the 20 per cent permitted.

The experimental replanted clearings on Dartonfield are now reaching a stage at which interesting results are being obtained, and these results are the subject of a paper by Mr. de Silva published in the Combined 3rd and 4th Quarterly Circular for 1937. The main conclusions are summarised below.

Experiment No. 1 1934 Clearing (7½ Acres).—This area was replanted with budded stumps in June, 1934, the purpose being to compare: (1) methods of disposal of the old timber; (2) species of ground cover crops; and (3) methods of controlling the ground cover. The only significant difference in rate of growth for the third year was between the plots planted with *Dolichos Hosei* (Vigna) and those planted with more vigorous covers. There is also an indication that *Calopogonium* is less competitive than *Pueraria* and *Centrosema*. The relevant figures are given in Table V.

TABLE V

Species of Cover	Mean girth in inches at 3 feet from union		Increase
	1936	1937	
<i>Dolichos Hosei</i> (Vigna)	5.43	9.66	4.23
<i>Calopogonium mucunoides</i>	5.51	9.36	3.85
<i>Centrosema pubescens</i>	5.16	8.93	3.77
<i>Pueraria phaseoloides</i>	4.95	8.61	3.66
Mean	5.26	9.14	3.88
Standard Error	—	—	.06
Significant difference (.05 probability)			.20

The difference between *Vigna* and the other species shows that some competition between the Rubber plants and the ground cover has existed, and it is perhaps surprising to find no difference between the two methods of controlling the covers viz., keeping the platforms clean weeded and ring-weeding in a 6 feet circle. It must, however, be stated that where the cover has been allowed to grow on the platforms it has been cut back and forked in once a year, and the platforms have received regular and fairly generous applications of artificial fertilisers.

There is a suggestion of poorer growth in the areas from which the lateral roots of the old trees were removed, but the difference is not statistically significant.

Experiment No. 2 1935 Clearing (13½ Acres).—This field was replanted with budded stumps in June, 1935, the main experimental object being to determine the fertiliser requirements of young budgrafts on replanted land. The value of digging in green manure is also being tested as compared with allowing the loppings to decompose on the surface. For the first two years no significant differences between the various treatments were evident, though towards the end of 1937 it was clear that the plots receiving no manure were putting on very little new growth. Unfortunately one replication has had to be excluded from the experimental comparisons owing to the detection of a "rogue" mixed with the clone Tjirandji 1, and as the accuracy of the trial is thereby greatly reduced it has been decided to replant the area and re-commence the experiment in 1938. Two further blocks will be replanted to bring the number of replications up to six.

Experiment No. 3 1936 Clearing (10 Acres).—The following series of comparisons are being made in this area:—

Methods of Opening.—

1. Planting on contour platforms.
2. Planting in contour trenches.
3. Contour planting, with level pitted drains between the contours.

Methods of Planting.—

- (a) Planting budded stumps. (Planted May, 1936).
- (b) Planted stumped buddings (Planted May, 1936).
- (c) Planting one basket plant and four germinated seed in each hole for subsequent budding in the field. (Planted September, 1936, and mostly budded November-December, 1937).

Manuring.—

- (x) A complete inorganic mixture.
- (y) A complete organic mixture.

No useful comparison of the methods of planting can be made at this stage. Although preliminary measurements of the girth of the stumped buddings have been made it would be premature to base any conclusions on

these figures as the girths at that time were still largely dependent on the conditions in the nursery from which the plants were taken. Only the height measurements of the budded stumps and of the seedlings have been taken into consideration, and these have been treated separately.

Table VI gives the comparisons for the methods of opening. It will be seen that in the case of the seedlings the growth has been significantly poorer in the "pitted drain" areas than in the "contour platform" and "contour trench" plots, while there is a strong indication of the same trend in the case of the budded stumps. This difference is probably to be attributed mainly to the greater ease with which the roots of the cover crops can grow close to and compete with the young plants where there are no earthworks in proximity to the holes. It will be interesting to see whether this disadvantage of the contour drain system persists.

TABLE VI

	<i>Seedlings.</i> Average height in feet in October, 1937	<i>Budded Stumps</i> Average height in feet in June, 1937.
Contour trenches	8.11	12.44
Contour platforms	7.98	11.00
Pitted drains	6.53	10.25
Mean	7.54	11.23
Standard error	367	
Significant difference (.05 probability)	1.17	Not significant

The comparison of organic vs. inorganic manure is at present inconclusive. In the case of the seedlings there is no significant difference, but with the budded stumps the organic manure has given an advantage in height of about 7 per cent. Although this difference is just significant it is hardly sufficient to justify the extra cost of the more expensive organic mixture.

III. ADVISORY WORK.

Advisory work has been carried out under the handicap of the absence of the Botanist and Mycologist for the greater part of the year.

1. Estate Visits.

The following visits were paid:—

Director	Botanist and Mycologist	Assistant Botanist.
2	10	14

2. Specimens and Enquiries.

Disease specimens were mostly referred to the Plant Pathologist, Department of Agriculture, during the undersigned's absence on leave.

Enquiries were received from estates and agency houses on the following subjects (figures for 1936 in brackets):—

Botanical.—

Budding and allied subjects (including choice of planting material)	133	(222)		
Replanting procedure	55	(163)		
Manuring	67	(49)		
Cover Crops	33	(58)		
Tapping	21	(23)		
Miscellaneous planting matters	83	(30)	392	(545)

Mycological.—

Oidium and sulphur dusting	34	(91)		
Other diseases	31	(32)	65	(125)
			Total	457 (668)

3. Visitors.

No separate record is kept of the number of visitors to the Botanical Laboratories, and the total number of visitors to Dartonfield is given in the Director's Report.

Mr. J. S. Vollema, Agricultural Officer of the Proefstation West Java, was a guest for about a week in November and in addition to the work on Dartonfield and Nivitigalakele was taken to see the Laboratories and Central Experiment Station of the Department of Agriculture and a number of estates.

IV. PUBLICATIONS.

1. Report on a Visit to Malaya, Java and Sumatra. Bulletin No. 54. R. K. S. Murray.
2. Ceylon Clones V.—*Quarterly Circular*, Vol. 14 Parts 1 and 2. C. A. de Silva.
3. Notes on the Propagation of *Pueraria phaseoloides*—*Quarterly Circular*, Vol. 14, Parts 1 and 2. C. A. de Silva.
4. Field Experiments on Dartonfield Estate V.—*Quarterly Circular* Vol. 14, Parts 3 and 4. C. A. de Silva.

5. Notes on the Growth of Budded Trees at Nivitigalakele Experiment Station.—*Quarterly Circular* Vol. 14, Parts 3 and 4. T. E. H. O'Brien.
6. Soil Erosion in Relation to Rubber Estates.—*Quarterly Circular* Vol. 14, Parts 3 and 4. T. E. H. O'Brien.

R. K. S. MURRAY,
Botanist and Mycologist.

Research Laboratories,
Dartonfield, Agalawatta.
24th January, 1938.

REPORT OF THE SMALLHOLDINGS PROPAGANDA OFFICER FOR 1937.

The period under review is of special interest as one inaugurating propaganda of practical benefit to Rubber smallholders in Ceylon by the Rubber Research Scheme. Although owing to the writer's absence from the Island on 3 months' special leave (April 25th—July 25th) — during which time smallholdings work was suspended — actually only 9 months' work is under review, more or less the full programme of work intended for the year has been carried out. The writer has to record his appreciation of the services of Mr. H. K. Wijeyasinghe, Rubber Instructor, Horana, and Mr. A. A. Silva, Clerk and Translator, in making this possible.

Staff.

(a) **Rubber Instructor, Horana Range.**—Mr. H. K. Wijeyasinghe functioned in this capacity. This officer also did part-time work in the Matugama range from August to December, pending the appointment of a new Instructor for the range. Mr. Wijeyasinghe was confirmed in his post in August after satisfactorily completing his year of probation. The range comprises more or less the whole of Raigam Korale and the Totamune division.

(b) **Rubber Instructor, Matugama Range.**—The probationary services of this officer were terminated at the end of May. The range includes the major portion of Pasdum Korales East and West.

(c) **Clerk and Translator.**—Mr. A. A. Silva who served in this capacity was responsible for the Sinhalese translations of publications issued by the Smallholdings Department during the year beside attending to clerical work and the keeping of books and accounts.

(d) **Additional Instructors.**—Following the decision of the Board to extend smallholdings work in 4 new ranges, 5 additional Rubber Instructors were advertised for and selected in December, the fifth Instructor being for Matugama. The candidates selected were Messrs. H. P. G. Peiris, L. A. Peiris, D. P. Gunawardana, N. T. M. C. de Silva and A. W. Abeyesena. These officers were appointed with effect from 17th January, 1938. A total of 323 candidates applied for the posts.

Demonstrations.—Demonstrations given by the Rubber Instructors to groups of smallholders in different parts of the ranges formed one of the principal means of instruction employed. The methods shown and recommended are simplified to be of practical benefit to smallholders and to suit smallholdings conditions generally. Demonstrations given were of three main kinds :—

(a) **Sheet-making.**—The making of a sheet from the bringing in of latex to admittance into smokehouse is shown. Much ignorance and haphazard methods prevail regarding cleanliness, dilution of the latex, straining, correct addition of acid, rolling and washing of coagulum, and the demonstrations serve a very useful purpose in these respects. A whole day is required for these demonstrations owing to the interval that has to be allowed for coagulation. A tapping demonstration is usually given during the coagulating interval.

(b) **Budding.**—The technique of budgrafting is shown and explained in detail. An added interest was shown by smallholders in these demonstrations owing to the extensive replanting operations in progress on estates in the district. Difficulty was at times experienced in obtaining suitable seedling plants for demonstrations.

(c) **Tapping.**—These demonstrations, given with the object of improving the generally poor tapping on smallholdings, show the correct method in which a tree should be marked and tapped. Owing to the comparatively short time taken, they are given, as far as possible, on the same day as one of the other demonstrations.

A total of 79 demonstrations was given in the two ranges, the attendance varying from 3 to 25. The number of demonstrations given during the latter part of the year had to be curtailed owing to the pressure of replanting and smokehouse work and the fact that only one Instructor was available. Demonstrations were personally supervised by the writer from time to time.

Apart from the above main demonstrations, Instructors have demonstrated to and assisted smallholders in a variety of subjects dealing with the improvement of their holdings and smokehouses.

Demonstration Smokehouses.

(a) **Ten Smallholders Smokehouses**—were erected at different centres in the two ranges (5 in each) for the purpose of demonstration. They were constructed under the supervision of the Smallholdings Department on selected roadside holdings at Rubber Research Scheme expense, the owner contributing the labour. These houses which have been previously described afford smallholders the design of a smokehouse built on correct principles, which is capable of holding eighty sheets, produces good sheet, lasts a considerable time and costs only Rs. 15/-. Although the majority of the houses were not completed till the end of the year, smallholders are beginning to evince considerable interest in them, one smallholder having already put one up at his own expense. Owing to the fall in price of rubber some of the owners of these houses are not tapping their rubber but those who are doing so are smoking sheet of very satisfactory quality. In addition to their own rubber some of them smoke their neighbours' sheet at a nominal charge. Notice boards explaining the main features of the house in Sinhalese are to be erected opposite each house.

(b) For the benefit of the somewhat large class of smallholder who gets only 1—3 sheets a day from his holdings and to whom even the Rs. 15/- house proves too large and costly, a "Minimum Size" smokehouse

was designed and constructed, and the results have been as satisfactory as those of the larger house. This house which measures 44 ins. by 22 ins. internally, costs only Rs. 8-50, has a capacity of 12 sheets, a drying period of 4 days (day smoking only) and a fuel consumption of $\frac{1}{8}$ cubic yard of wood fuel for 6 days (day smoking). The house, in plan, resembles the larger model and possesses all its main features with a few minor modifications to ensure economy and reduction in size. The idea for this house originated from the Rubber Instructor, Horana, from his personal experience of the requirements of smallholders.

Specifications and plans of both types of smokehouses were embodied in a leaflet on "The Production of Smoked Rubber Sheet" which will be issued early in 1938.

The Instructors visited a number of smallholders' existing smokehouses to suggest improvements and advise on smoking. A common fault is the absence of ventilation.

Replanting Experiments.—The experimental replanting of two blocks of smallholdings for the purpose of (a) working out costs under actual smallholdings conditions and (b) demonstration, was carried out in the Horana range during the North East Monsoon. The areas replanted were $\frac{1}{2}$ an acre at Kahatapitiya and $\frac{3}{4}$ acre at Ratmalgoda. The work was carried out under the close supervision of this department with the vote allowed for the purpose, the owners however voluntarily contributing the cost of fencing and clearing. The blocks were laid out on the system of contour rows alternating with contour bunded drains, the $\frac{1}{2}$ acre being planted with budded stumps of Tjirandji 1 on October 29th and the $\frac{3}{4}$ acre with stumps of R.R.S. 6 on November 1st. At the end of December 69 out of 75 and 91 out of 116 stumps had sprouted in the respective blocks and both blocks had made very satisfactory progress. Costs at Ratmalgoda, where the land is steeper and the soil stiffer than at Kahatapitiya, have been slightly higher. Notice boards are to be erected opposite each block and detailed costs will be attached to the leaflet on replanting that has already been prepared.

Advice on replanting was given to a number of smallholders, a few of whom have undertaken replanting operations.

Competitions.—Notices in Sinhalese in respect of two competitions for rubber smallholders in the Horana range were printed and issued. The competitions which are to commence early in 1938, are for the "Best-kept Rubber Smallholdings" and "Best Smoked Sheet" respectively, and are confined to owners of $\frac{1}{2}$ to 5 acres. The notices, which invited entries, also explained the terms of each competition, the prizes offered, manner of allotting marks in judging etc. Marks were allocated in such a manner as to encourage competitors to give effect to the recommendations of the Smallholdings Department.

Seedling Nurseries.—As a means of overcoming the difficulty of finding suitable blocks for giving budding demonstrations and providing budding practice to smallholders, 12 seedling nurseries were laid down at 12 suitable

centres (smallholdings) in the two ranges. The nurseries which contain about 14,000 seedlings, may, in addition to the purpose explained above, be availed of later for supplying budded stumps to smallholders.

Marketing of Rubber.—Further enquiries were made regarding the feasibility of inducing small rubber dealers to purchase smallholders' rubber on a system of grading. It was suggested that the dealers should exhibit notice boards indicating the prices they were prepared to pay each day for sheet conforming to 5 representative samples which would be fixed to the boards. The majority of dealers interviewed, whilst admitting the equity and advantages of such a scheme if properly organised, expressed the opinion that unless the scheme was adopted by all the dealers in any one town, the few who attempted it would, owing to the bulk of smallholders' rubber being of poor quality, tend to become unpopular among smallholders and lose business.

It is felt that the scheme is too large a one to be undertaken by this department alone, but one worthy of the assistance of the Agricultural Marketing Department or similar body, if smallholders are to be encouraged to make better quality rubber.

Planting Material.—A total of 805 budded stumps and 60 yards of budwood was sold to small owners through this department. Several persons who had booked material, subsequently cancelled their orders owing to failure to obtain permission to replant in time. An advertisement calling for bookings for 1938 was inserted in the Sinhalese newspapers and a few applications received.

Instruction in Budding.—A six day course of instruction in budding was arranged for smallholders at the Experiment Station, Nivitigalakele. 11 persons attended. Instruction was given by the Budding Instructor of the Rubber Research Scheme. A certificate was issued by the Director to those obtaining satisfactory successes with their budding. More such classes will be arranged as required.

In a few cases, and as other duties permitted, Rubber Instructors assisted smallholders in budding their clearings and in instructing in budding.

Testing of Coagulants.—With a view to testing the purity of acid sold to smallholders by local dealers, twelve samples of acid were purchased from dealers in the Horana range and submitted to the Chemist for test. The report showed ten of them to be good samples of formic or acetic acid while one was a poor sample of acetic acid and one was acetic acid sold as formic acid. The dealer who sold the latter was duly warned. Similar tests are to be made periodically in each range.

The price of formic acid sold by the different dealers varied from Re. 1/- to Rs. 1/20 per bottle and that of acetic acid from 60 to 80 cents.

Matale Show.—The department participated in the Agricultural Week-end organised by the Propaganda Division of the Department of Agriculture at Matale on 30th and 31st July. Considerable interest was shown

by visitors in the model of the Rs. 15/- smokehouse, budding demonstrations and vulcanised rubber products made by the Chemical Department, which were also on view. Participation in such shows was felt to be a useful means of propaganda, especially when they are held in Rubber areas to which our activities do not at present extend.

Publications.—The following publications were issued:—

1. Leaflet on “Replanting of Rubber” — in Sinhalese and English.
2. Leaflet on “Notes on Budgrafting Procedure” — translated from an existing leaflet.

A leaflet on “The Preparation of Smoked Rubber Sheet” was also written and submitted to the Director.

Correspondence.—Correspondence during the year which was partly in Sinhalese was as follows:—

Inward	...	819.
Outward	...	677.

The duplication of correspondence in Sinhalese for office record by the method of carbon copy is not very satisfactory but is being continued for want of a better system.

Visits and Inspections.—Each range was visited on an average once a week. During such visits the work of the Instructors was inspected and smallholdings visited. Estates were also visited by invitation.

Acknowledgments.—The writer wishes to place on record his thanks to the Mudaliyars, Chairmen of Village Committees, Headmen and various other gentlemen in the Kalutara District for their co-operation and interest in the activities of the Smallholdings Department during the year.

W. I. PEIRIS,

Smallholdings Propaganda Officer.

Smallholdings Department,
Nivitigalakele Experiment Station,
Matugama.

ESTATE SUPERINTENDENT'S REPORT FOR 1937.

DARTONFIELD ESTATE.

Acreage Statement.

Mature Rubber	...	...	130 acres.
Immature Rubber	...	...	33½ „
Building sites, roads, etc.	...	...	13½ „
Total			<u>177 acres.</u>

The figures for mature Rubber and building sites are approximate. A re-survey of the estate will be made in 1938.

Census of Trees.—Numbering of each tree in different fields was undertaken and the census records so derived are given below :—

Field	No. of trees	Approx. acreage in tapping.
No. 1	2,858	29
„ 2	75	1
„ 3	3,615	38½
„ 4	355	3
„ 5	Replanted	
„ 6	5,540	58½
Total	12,443	130

Rainfall.—The rainfall amounting to 180.52 was above normal, but weather conditions were generally favourable for crop intake. Details of rainfall during 1937 and the preceding year appear below :—

	1936	1937
January	1.78 ins.	11.11 ins.
February	3.26 „	9.17 „
March	14.20 „	5.09 „
April	3.31 „	21.51 „
May	49.24 „	36.34 „
June	9.02 „	8.81 „
July	13.04 „	20.36 „
August	2.33 „	7.88 „
September	14.67 „	18.06 „
October	16.63 „	16.88 „
November	30.98 „	19.96 „
December	9.84 „	5.35 „
Total	168.30 ins.	180.52 ins.

Crop.—The estimated crop for the year was secured, despite a deficit in the early months.

Field No.	Total crop lbs.	Approximate Acreage	Yield per acre lbs.
No. 1	17,851	29	615.5
" 2	1,120	1	1,120.0
" 3	20,790	38½	540.0
" 4	2,520	3	840.0
" 6	35,739	58½	610.9
Total	78,020	130	600.1

Estimated crop 78,000 lbs. Percentage of estimate harvested—100 per cent.

Crop figures for the Forestry area, which forms a part of Field No. 1, are as follows:—

	1936	1937
January-June	6,235 lbs.	5,665 lbs.
July-December	7,736 "	7,636 "
Total	13,971 lbs.	13,031 lbs.

These figures are not strictly comparable as a few trees were removed for part of a building site and roads.

Tapping.—Tapping was continued on the double four system, except in the area under a tapping experiment, and the results continue to be satisfactory. Particularly attention has been given to maintaining full tapping depth. Bark consumption was normal, averaging 3¼ inches on each side. General supervision of tapping in the experimental areas was exercised by the writer under the direction of the Botanist.

Analysis of Tapping Rounds.

	Early tapping	Late tapping (before 10 a.m.)	Very late tapping	Partial washout	Washout	No tapping due to rain	Holidays
January	24	2	2	—	—	—	3
February	15	—	1	—	—	—	—
March	17	—	—	—	—	—	—
April	18	3	6	3	—	3	—
May	7	3	9	2	2	11	1
June	20	1	8	4	—	1	—
July	14	3	5	1	—	9	—
August	26	1	3	—	1	1	—
September	23	—	2	1	1	5	—
October	19	2	7	—	—	3	—
November	16	3	7	1	2	2	2
December	28	2	1	—	—	—	—
	<u>227</u>	<u>20</u>	<u>51</u>	<u>12</u>	<u>6</u>	<u>35</u>	<u>6</u>

Average intake per tapper.

January	...	9.1 lbs.
February	...	8.1 "
March	...	
April	...	9.0 "
May	...	8.2 "
June	...	10.0 "
July	...	10.1 "
August	...	10.3 "
September	...	9.7 "
October	...	10.4 "
November	...	10.3 "
December	...	11.7 "

Manufacture.—The main products were smoked sheet and crepe which were sold on the local market and realized good prices. Four consignments of ammoniated latex, totalling 2,000 gallons were shipped to London. This form of manufacture is now under routine estate control. One ton of nitrite crumb was prepared.

Details of grades are as follows:—

Grades	lbs.	%	Total %
Smoked sheet No. 1	14,371	18.42	18.85
" " " 2	274	.35	
" " " 3	60	.08	
Latex crepe No. 1	39,677	50.85	54.14
" " " 2	1,869	2.40	
" " " 3	698	.89	
Scrap crepe No. 1	5,223	6.69	11.39
" " " 2	3,665	4.70	
Crumb rubber	2,395	3.07	15.62
Latex	9,788	12.55	

Machinery.—Expenditure on machinery upkeep was relatively heavy. Water pumps and the sheeting mill were repaired and the Ruston engine overhauled.

The engines were operated on Diesel oil in the latter part of the year without loss of efficiency. Details of fuel consumption are given below:—

	Large Engine (Ruston Hornsby 52-57 H.P.)			Small Engine. (Lister 9 H.P.)		
	Hours worked	Diesel oil. gals.	Lubric. oil. gals.	Hours worked	Diesel oil. gals.	Lubric. oil. gals.
1937	1918½	2599½	178	1558	764	31½
Average per hour		1.35	.09		.49	.02
1936	1096	1223½	103½	1796¼	893½	34½
Average per hour		1.12	.095		.50	.02

Pests and Diseases.—Approximately 80 per cent. of the trees had refoliated before symptoms of Oidium infection became evident. The attack on the late wintering trees was fairly severe. One round of sulphur dusting was carried out at 4 lbs. sulphur per acre.

A fairly sharp attack of phytophthora, though less severe than in 1936, was experienced with the advent of wet weather in July.

Two cases of *Fomes lignosus* occurred in the mature area. One was a new case, while the other was a recurrence of infection in an area treated before the Scheme had taken over management of the estate.

A recent census of diseased trees showed that 1.22 per cent. were affected, viz:—

Field	Brown Bast	Ustulina	Total
No. 1	24	21	45
„ 2	—	—	—
„ 3	38	20	58
„ 4	6	2	8
„ 5	—	—	—
„ 6	22	10	32
Total	90	53	143

In most cases the disease was not sufficiently severe to necessitate removal of the trees.

Cargilineum Mixture "B" and a 3 per cent. solution of Izal are applied to tapping cuts, in wet weather, as a prevention against bark rot.

Cases of canker, although present, have not been greater than in previous years.

Weeding.—Selective weeding is being continued and undesirable growths, such as grasses, bracken, and Mikania are being removed. There has been no substantial increase in the growth of natural covers, but control was found necessary and one round of lopping was done.

Cultivation.—The first cycle of regular biennial manuring of the mature Rubber was completed during the year. Fifty acres were manured in 1936 and a further 50 acres in 1937, with a mixture consisting of 3 parts sulphate of ammonia and 1 part saphos phosphate, at 400 lbs. per acre. Forking was done in January and the manure broadcast over the forked areas during March-April. The area under forestry methods, which was omitted for experimental reasons, will be manured in 1938. 20 acres set apart for manurial trials received treatment according to experimental requirements.

Silt Pits.—Silt pits were cut in lateral drains in the area manured during the year and in the forestry area.

Cover Crop.—Development of the cover of *Pueraria* was satisfactory and more than $\frac{2}{3}$ of the acreage now carries a fairly good cover. Backward areas were successfully supplied with marcotted cuttings. The young supplies received two applications of the following fertiliser mixture, at the rate of 3 oz. per bed:—

Bonemeal	...	...	3 parts
Saphos phosphate	...	...	2 „
Nitrate of soda	...	...	1 part
Nitrate of potash	...	...	1 „

Labour.—The labour force of Tamils has been adequate for normal estate requirements. The general demand for village labour remained about the same and the turnout was good, except for interruptions during the paddy harvesting and cultivation seasons.

Monthly Total of Labour on Check-Roll.

		Tamils	Sinhalese	Total.
January	...	83	43	126
February	...	65	28	93
March	...	67	23	90
April	...	60	61	121
May	...	57	78	135
June	...	57	77	134
July	...	58	73	131
August	...	56	57	113
September	...	58	70	128
October	...	63	62	125
November	...	69	55	124
December	...	67	39	106

Figures for daily turnout and daily rate of pay are as follows:—

Average daily out-turn	...	73
Average wages per day	...	44.2 cents.

Cart Road, Roads and Paths.—A bridge on the main approach road by Galawatte factory was reconstructed. A cattle bridge 12 ft. by 6 ft. was also constructed at the entrance to the inspection road which runs through the upper part of the estate. All roads were maintained in satisfactory condition during the year.

Experimental Areas.

No. 1 area replanted in 1934	...	7½ acres
„ 2 „ „ „ 1935	...	13 „
„ 3 „ „ „ 1936	...	10 „

The writer has exercised supervision of routine work in the three clearings, in accordance with the instructions of the Technical Officers.

Buildings.—An estate office including visitors' room and lavatory was constructed on a site near the factory. The work was done under estate supervision by a local contractor who also installed the water and drainage service. Roofing materials, doors and windows, taken from the demolished laboratory at Culloden, were re-used for the buildings. The motor shed was moved to a suitable site on the factory premises, and extended by one section.

A cattle shed was constructed in accordance with a plan provided by the Government Veterinary Surgeon.

The staff tennis court was completed in December. Initial progress was slow owing to an unexpected amount of dynamiting.

NIVITIGALAKELE.

Acreage Statement.

Nivitigalakele Division.

1926 Clearing	...	...	12 acres
1927 ,,	...	...	16 ,,
1938 ,,	...	...	33 ,,
Nurseries, buildings, etc.	...	...	8½ ,,
			Total 69½ acres

Pinnagoda Division.

1935 Clearing	...	...	28 acres
Budwood Multiplication Nursery	...	...	6½ ,,
Seedling Nursery	...	...	1 acre
Swamp area planted with seed of known origin	...	...	½ ,,
1936 Seedling Nursery	...	...	2 acres
Uncultivated	...	...	62 ,,
			Total 100 acres

Rainfall.—168.74 inches.

Crop.—The crop harvested for the year amounted to 8,968 lbs., against an estimate of 8,500 lbs.

Tapping.

Commercial Tapping.—610 trees of 20 inches girth and over were brought into tapping, bringing the total number in commercial tapping to 1,634 trees. Tapping cuts were changed over to 36 ins. on the opposite side and cuts on new trees were opened at the same height.

Test Tapping.—12 additional clones were brought into test tapping in the 1938 clearing. These bring the total number of trees under test tapping to 1,043.

Pests & Diseases.—The incidence of Oidium infection was comparatively mild owing to the rapidity of refoliation, and only a few of the late wintering clones were affected. One round of sulphur dusting was carried out over the whole area, and a partial round over 20 acres.

Wind Damage. Further cases of wind damage occurred during the monsoon gales in October. The damage, as in previous cases, was mainly confined to certain clones with a heavy branching habit, or to trees with a malformed root system.

Manuring.—Manuring of the old clearings was commenced in August. In the 1926; 1927 clearings and fields 4B and 4C of the 1928 clearing, sulphate of ammonia was broadcast at 200 lbs. per acre. The remainder of the 1928 clearing received an application of 200 lbs. of the following fertiliser mixture, which was forked in with green manure:—

Calcium cyanamide	...	...	6 parts
Bonemeal	...	...	2 „
Saphos phosphate	...	...	1 part
Nitrate of potash	...	...	1 „

Pollarding of Low Branches.—Gliricidias were removed and low branches pollarded in the 1926 and 1927 clearings, with a view to improving the rate of drying of tapping cuts during wet weather.

Instruction in Budgrafting. Courses of instruction in budgrafting were held for the benefit of estate employees and other learners. 130 students attended.

Cart Road.—Construction of the road to Pinnagoda division was not started until September, owing to unavoidable delay in acquisition of two blocks of village land required for the purpose. Progress thereafter has been good and a little more than half the total length of the road has been completed, except for a bridge and a few culverts.

Buildings.—Buildings constructed under estate supervision included:—

- (1) Engine and pump house.
- (2) Motor shed for the Smallholdings Propaganda Officer.

Minor alterations and improvements were effected to the estate office. A part of the building now forms the permanent office of the Smallholdings Department.

PINNAGODA DIVISION.

Budded Plants.—Budgrafting was completed in the remainder of the seedling areas, according to the procedure described in the report for 1936.

Cultivation.—38 blocks of the earlier buddings of local clones and AVROS. 50, which were allotted to a compost experiment, were manured in August according to experimental requirements.

The special seedlings were manured for the first time with an application of $1\frac{1}{2}$ lbs. of the following fertiliser mixture:—

Sulphate of ammonia	...	...	4 parts
Bonemeal	...	...	1 part
Bloodmeal	...	...	2 parts
Saphos phosphate	...	...	2 „
Muriate of potash	...	...	1 part

The manure was forked in together with green manure loppings.

The later buddings received $\frac{1}{2}$ lb. of the same mixture. Of these, the youngest plants received the manure in two applications of $\frac{1}{4}$ lb. each.

Nurseries

Budwood Multiplication Nurseries — 6 Acres.—Budding of seedling plants in this area was completed.

1935 Seedling Nursery — 1 Acre.—This nursery formed the main source of budded stumps disposed of during the year.

1936 Seedling Nursery — 2 Acres.—The planting of this area, which was delayed owing to shortage of seed, has been completed. A consignment of 30,000 seed was obtained from an estate in the Moneragala district in March, but only 24 per cent. germinated satisfactorily. The remaining area was planted in July-August with seed procured or collected locally. Prior to planting, the beds were dug up to a depth of 1 ft. by 2 ft. wide along the line of planting, and deep forked another 12 inches before being filled. A few beds were opened on an alternative system in which holes 8 ins. wide by 2 ft. deep were cut 18 ins. apart in rows, which were themselves spaced at 18 ins. Three germinated seeds were planted in each hole 4 ins. apart. The total number of seed planted out amounts to a little over 52,000.

Sale of Budded Stumps and Budwood.—10,137 budded stumps and 1,632 yards of budwood were disposed of during the year.

Budding results for the season are as follows:—

		No. budded	No. successful	Per cent. success
March	...	4,116	2,825	68
April	...	5,156	3,922	76
May	...	2,416	2,113	87
June	...	3,649	3,283	90
July	...	40	35	87
August	...	2,094	1,249	59
September	...	2,056	1,941	94
October	...	547	450	82
November	...	78	72	92
December	...	201	129	64
Total		20,353	16,019	78.7

Staff.—The services of Mr. S. B. O'Neil (Conductor) were discontinued in January and Mr. M. T. de Silva appointed in his place.

Mr. H. J. Fernando was transferred to Nivitigalakele as Budding Instructor in May.

WAGOLLA.

Budded Rubber Area.—Test tapping of this area, which forms a part of the Wagolla Farm School and consists of 203 trees, was started in July. A trained tapper, transferred from Nivitigalakele, was entrusted with the work under the general supervision of the Agricultural Instructor in charge of the school.

Tapping is carried out according to the procedure followed on Niviti-galakele. The Conductor visits the station monthly to inspect the work and bring back the test tapping biscuits. The writer paid two visits, one in July, after the work had been started, and another in December. A high standard of tapping is being maintained. Pueraria was planted during the monsoon rains in October and subsequent growth has been satisfactory.

D. L. NICOL,
Superintendent.

Dartonfield Estate,
Agalawatta.
8th February, 1938.

REPORT OF THE LONDON ADVISORY COMMITTEE FOR RUBBER RESEARCH (CEYLON AND MALAYA) FOR 1937.

The Committee and Technical Sub-Committee held three meetings during the year.

The Committee regret to report that Mr. H. E. Miller and Mr. W. J. Gallagher, both of whom had rendered very valuable services for several years, were unable to continue their membership of the Committee. Messrs. Eric Macfadyen and J. L. Milne were appointed by the Rubber Growers' Association to replace them as representatives of rubber planting interests in Malaya.

Meetings of the Committee and Technical Sub-Committee were attended by the following visitors from Ceylon and Malaya:—

Rubber Research Institute, Malaya.

Lieut.-Col. B. J. Eaton — Late Director.

Mr. J. D. Hastings — Chemist.

Mr. H. Fairfield Smith — Statistician.

Rubber Research Scheme, Ceylon.

Mr. I. L. Cameron — Board of Management.

Mr. R. K. S. Murray — Botanist and Mycologist.

Department of Agriculture, F.M.S.

Mr. G. H. Corbett.

At the request of the Research Association of British Rubber Manufacturers Mr. Le Bras, a member of the research staff of the Institut Français du Caoutchouc, spent a fortnight working in the Committee's laboratories where he was instructed in the technique of latex testing.

Several conferences were also held with Dr. Kraay, Superintendent of Rubber Investigations, West Java Proefstation at which details of the programme of work of the two organisations were discussed.

FINANCE.

Contributions of £2,625 and £875 were received from the Rubber Research Institute, Malaya and the Rubber Research Scheme, Ceylon respectively towards the cost of the work of the Committee during the year 1937. The expenditure incurred amounted to £3,470.4s.8d. and after allowing for reserve for plant and for liabilities outstanding, there was an unexpended balance of £900 at 31st December, 1937.

APPOINTMENT OF STAFF IN CEYLON AND MALAYA.

At the request of the Director of the Rubber Research Institute, Malaya steps were taken to select candidates for the following vacancies:—

- (1) Botanist;
- (2) Advisory Officer, Botanical Division;
- (3) Chemist;
- (4) Statistician;
- (5) Assistant at the Experiment Station.

An advertisement was also issued in the press in this country on behalf of the Ceylon Rubber Research Scheme inviting applications for the post of Geneticist to be submitted direct to the Chairman of the Board. The Committee were subsequently requested to interview and make the final selection from certain of the candidates regarded by the Board as the most suitable. It was, however, found that all the candidates concerned had accepted other appointments and the Committee were then asked to re-advertise the post, receive the applications and submit a name for appointment by the Board. At the end of the year a selection was being made for the post.

STANDARDISATION OF RAW RUBBER.

In 1936 the attention of the Committee was drawn by the Research Association of British Rubber Manufacturers to the difficulties experienced by certain manufacturers in obtaining uniform supplies of raw rubber and products suitable for their industrial requirements and the possibility of supplies of certified rubber being offered.

These difficulties were referred to a Sub-Committee which met on two occasions during the year. In view of the renewed interest being displayed in the subject by manufacturers in this country and the U.S.A., and the developments which are arising in connection with competitive synthetic products the Sub-Committee suggested to the Rubber Research Institute, Malaya and to the Rubber Research Scheme, Ceylon that further attention should be given in their programmes of work to the variability of raw rubber and to the possibility of obtaining uniform rubber from selected estates. As a result a scheme of investigation in continuation of the experiments on the variability of Ceylon estate rubber carried out in collaboration with the Committee some years ago has been approved by the Board of Management in Ceylon. The Director of the Rubber Research Institute, Malaya stated that some research on standardisation would be dealt with in the programmes for 1938, but he pointed out that the cost of a systematic survey of the output of a large and representative selection of Malayan estates for not less than one year would be considerable and without the employment of additional staff could not be undertaken without giving up the whole of the existing work for the period of the enquiry. He asked that before submitting a proposal of this character to the Board he should be furnished with precise information as to the requirements of different types of consumers.

Arrangements were accordingly made for an agreed statement giving the data required to be prepared by manufacturers on the Sub-Committee in consultation with the Crude Rubber Committee of the American Chemical Society. This had not been received by the end of the year.

INVESTIGATIONS.

Hitherto the work has consisted chiefly of *ad hoc* investigations dealing with the production and quality of latex and raw rubber but in view of the developments in the competition from synthetic materials, whose technical advantages over rubber depend upon fundamental differences in structure and chemical composition, it is considered desirable now to devote more attention to long range investigations such as the colloidal structure of latex and changes in the caoutchouc phase of rubber on keeping under different conditions. The investigations on latex have already given considerable information concerning the cause of creaming and the factors affecting the efficiency of the process. They have also added to the data available with regard to the effect of ammonia on latex and the treatment required in order to obtain from latex a rubber which does not readily absorb water and which is, therefore, of special value for the electrical industries.

The development of tests for determining the quality of latex referred to in the Report for 1936 has been stimulated by co-operation with the British Standards Institution and associated organisations. New tests for extraneous matter have been evolved and the tests previously suggested for stability and for dry rubber content have been modified and improved. A survey of the whole of the work carried out by the staff on the development of scientific tests for determining the quality of latex was given in a paper read by Mr. Davey before the London and Midlands Sections of the Institution of the Rubber Industry. It is of interest to record that as a result of proposals made arising out of this work, after consultation with other interested organisations, cheap colour standards for latex are likely to become available to the trade shortly.

Research on the incorporation of bitumen in rubber by the scientific staff of the London Advisory Committee in association with the technical staff of the Limmer and Trinidad Lake Asphalt Company Ltd., was continued on behalf of the Technical Research Committee of the Rubber Growers' Association.

Experience with highway surfacing trials described in previous reports indicates that there is little apparent difference between a freshly laid bitumen carpet containing rubber and one without rubber, but in the course of time there appears to be less tendency for the carpet containing rubber to "flush-up" and become smooth. As "flushing up" of bitumen is due to its flow properties it was decided to broaden the research with a view to obtaining a more complete picture of the causes of these properties over a wide range of conditions. The results so far obtained have confirmed the previous conclusion regarding the value of small proportions of rubber in reducing the flow tendency of bitumen.

Complementary work on the roads has been continued and will be extended in 1938. While it is early to draw definite conclusions the evidence available on the use of bitumen/rubber compositions appears encouraging.

The use of latex cement mixtures for flooring and other purposes is attracting considerable attention in Great Britain and a paper read by Mr. Wren before the London and West of England Sections of the Institution of the Rubber Industry in October and December respectively, describing the work carried out on the subject during the last three years, has been in considerable demand. Recent work on the subject has been devoted principally to formulating, by experimental trials, practical mixtures for use based on the principles evolved in the fundamental work previously carried out and in devising physical tests which will enable standards to be formulated for different qualities of material.

As in previous years, the staff in London co-operated with the chemists in the East in the examination of samples prepared in connection with experiments in Ceylon and Malaya. A list of the reports furnished on these investigations and on others initiated in the Committee's laboratories is given below. Further information as to the investigations completed and in progress during 1937 will be found in the technical appendix to this report.

CO-OPERATION WITH OTHER ORGANISATIONS.

Mr. Martin continued to serve as a representative of the Research Association of British Rubber Manufacturers on the Joint Committee of that Association and the British Electrical Research Association dealing with the quality of ebonite. Trials arranged by the Joint Committee with samples of rubber prepared in Malaya show that the ebonites with the least water absorption have the best electrical properties and *vice versa*.

Mr. Martin has also acted as representative of the Rubber Growers' Association on Committees of the British Standards Institution appointed with a view to co-ordinating methods of testing rubber and latex to be employed in specifications for a variety of manufactured articles.

Throughout the year the Building Research Station has been kept informed of the progress of investigations on latex cement mixtures and the thanks of the Committee are due to the Association for a number of useful suggestions.

PATENTS.

As in previous years, abstracts of English patent specifications in respect of inventions relating to processes for the preparation and/or utilisation of raw rubber and latex were made for the information of the Rubber Growers' Association, the Rubber Research Scheme (Ceylon) and the Rubber Research Institute (Malaya) and copies of specifications of special interest were obtained for the research organisations in the East.

In conjunction with the Rubber Producers' Research Association steps were taken to obtain English patents in connection with inventions arising out of the work of the staffs in London and in the East.

Applications sealed during 1937.

465,226.—Organic Liquid Addition to Latex. (Communicated by the Rubber Research Institute of Malaya).

Complete Specifications filed during 1937.

30,770/36.—Rubber and Cement Mixtures.

Complete Specifications accepted during 1937.

474,651.—Concentration of Latex by Creaming. (Communicated by the Rubber Research Institute of Malaya).

476,073.—Stabilised Cream. (Communicated by the Rubber Research Institute of Malaya).

476,269.—Brominated Rubber.

476,743.—Preparation of Chlorinated Rubber.

Provisional Specifications accepted during 1937.

19,543/36.—Softened Rubber from Stearate Crumb. (Communicated by the Rubber Research Scheme, Ceylon).

REPORTS ON INVESTIGATIONS FORWARDED TO CEYLON AND MALAYA DURING 1937.

Creaming of Latex.

Latex creamed with sulphonated lorol.

Purification of latex.

Microscopic study of creaming phenomena (two reports).

Preservation of Latex.

Latex preserved with different amounts of ammonia.

Storage of latex under tropical conditions.

Latex preserved with different amounts of ammonia.

Latex (General).

Comparison of latex concentrated by evaporation and filtration.

Filtered latex.

Samples received from the Ceylon Rubber Research Scheme.

Purification of latex by treatment with proteolytic enzymes,

Investigations connected with the preparation of rubber.

Chlorinated and brominated derivatives of rubber from latex.

Effect on quality of sun drying wet coagulum.

Low water absorption rubber

The use of phenylhydrazine derivatives as softening agents for rubber.

Miscellaneous.

Miscellaneous investigations.

Examination of samples of Buna.

P. J. BURGESS,

Chairman

J. A. NELSON,

Secretary

Imperial Institute,
28th April, 1938.

TECHNICAL APPENDIX TO REPORT OF THE LONDON ADVISORY COMMITTEE FOR RUBBER RESEARCH (CEYLON AND MALAYA) FOR 1937.

LATEX.

1. SPECIFICATION AND TESTING.

The devising and development of tests for the quality of latex referred to in previous reports have been stimulated by the interest in the subject now displayed by the British Standards Institution in Great Britain and the Crude Rubber Committee in the U.S.A. The staff have co-operated with the former in formulating recommended methods of testing and most of the suggestions submitted on behalf of the Committee have been accepted. Tests for the determination of coagulum and other undesirable solids have been devised, and new information has been obtained from further work on colour and stability of liquid latex and on tensile strength and ageing properties of dried latex films.

Colour of Liquid Latex.—The colour of latex is not an accurate measure of quality but the trade make a rough classification by colour when valuing latex and some time ago drew the attention of the Committee to the need for a cheap and simple set of standards for their purpose. The apparatus devised by the staff, and referred to in previous reports, has been in general use in the Committee's laboratories throughout the year and whilst it has not been possible to match the colour of every sample examined owing to the multiplicity of shades encountered a classification sufficiently accurate for practical purposes was always made.

The results obtained with the matching outfit were brought to the notice of the British Standards Institution who propose to reproduce the nine shades on a card, the colours being obtained by dispersing magnesium carbonate, cadmium sulphide and carbon black in a cellulose compound. It is anticipated that these colour cards will be available at a very low cost to all who are interested in the production and marketing of latex. Similar colour cards are already available as standards in the paint industry. Owing to the cellulose compound not being absolutely resistant to atmospheric influences these cards do not remain serviceable for more than two years, and this limitation would probably apply to the cards proposed for matching the colour of latex.

Stability.—The apparatus devised and constructed in the Committee's workshops for the determination of stability has been re-designed, the chief alterations being (a) the apparatus is more compact, (b) control of temperature of testing is more accurate and (c) the rate of stirring has been

increased from 600 to 2,000 revs. per minute, thus reducing the time required for the test to approximately one fifth of that previously necessary. The experience gained during the year confirms the general utility of the test.

Previous experiments showed that in order to obtain reproducible results with this apparatus it is necessary to use the same supply of zinc oxide. It has now been found that samples of the same grade from different sources give fairly uniform results, but there is sufficient variation to necessitate carrying out comparative tests when using a fresh supply of zinc oxide.

Reference was made in last year's Report to stability tests using sodium silicofluoride as a coagulant. This may be regarded as typical of the chemicals used for the coagulation of preserved latex and may give different results from zinc oxide, which does not coagulate latex unless stirred vigorously and which, therefore, owes its effect chiefly to the mechanical action of stirring, although the chemical reaction between zinc oxide and ammonia has a marked effect on the result. Some experience has now been gained with other salts as coagulants and some of them such as magnesium chloride, calcium chloride, aluminium acetate and ammonium alum give promising results. So far no marked discrepancy has been observed between the results with chemical coagulants and those with zinc oxide, and since there is always the danger that chemical coagulants may be specific in their effect, the zinc oxide test is at present preferred.

Coagulum and Other Undesirable Solids. - The terms of the Rubber Trade Association standard contract specify that latex should be free from extraneous matter, such as bark, leaves, etc., but however carefully latex is prepared it always contains a certain amount of inherent but undesirable solids which can be divided into two groups, viz., coarse material such as coagulum and fine material consisting largely of inorganic matter. It is difficult to determine accurately the weight of this material when separated by the ordinary type of sieve and moreover the sieve cannot be cleaned satisfactorily. A modified sieve has, therefore, been evolved in which a weighed disc of stainless steel gauze is clamped between two rings, through which the latex is strained and the residue washed. The sieve is then dismantled and the disc and residue dried and reweighed.

The finely divided material is determined by centrifuging a known volume of latex in accurately calibrated tubes in a standard centrifuge for a fixed period of time at a speed of 2,000 revs. per minute. The centrifuge tubes recently recommended by a Committee of Public Analysts for the estimation of dirt in milk (Analyst, 1937, 62, 287) have been found to be suitable for this purpose.

The results of tests on a few samples of latex indicated that the coarse material generally forms less than 1 part per 1,000 of latex (by weight) and the finely divided sediment seldom exceeds 10 parts per 1,000 (by volume). The finely divided sediment is, of course, much less in latex concentrated by centrifuging than in other types.

Tensile Strength of Dried Latex.—The determination of the tensile strength of dried latex films has been recommended as a test by some organisations and has been used tentatively by the London staff, who have now shown that the results are markedly affected by conditions such as the thoroughness of drying, rate of stretching of the test piece, and temperature of testing. It has also been shown that when the films are dry they rapidly become stronger at atmospheric temperature, presumably due to polymeric changes in the caoutchouc. At much higher temperatures they may become stronger for a time and then weaken. In these circumstances it is difficult to formulate testing conditions which will ensure reliable results. On the other hand the test is of some value because experiments indicate that it can be used to detect latex which has been treated by oxidising agents to promote a white colour and which usually gives a low tensile strength figure particularly on ageing.

2. PRESERVATION.

(a) **Bactericides.**—Although ammonia is an excellent preservative for most purposes, there are some uses for which its pungent odour is objectionable and the Rubber Research Institute has continued its search for a suitable substitute. New bactericides are frequently placed on the market, and as opportunity arises, samples are forwarded from London to the East for trial. This year those forwarded include Nipasin M, a range of organic thiocyanates, isothymol, chlor-iso-thymol, merthiolate and propyl and ethyl hydroxybenzoate, all of which proved to be either unsatisfactory or uneconomic. On the other hand a sample of latex has been received from the Rubber Research Institute treated with a little ammonia and sodium pentachlorophenate and the latex has remained in a fluid condition for about six months, although during this time a decline in stability has taken place. Sodium pentachlorophenate is regarded as a promising new preservative, but more experience is required before definite conclusions can be drawn.

(b) **Keeping Properties.**—An examination of a sample of latex which had been stored in Ceylon for a year indicated that the latex had deteriorated as regards colour, stability freedom from coagulum and mineral impurities, and resistance to ageing, although apart from the bad colour the results still compared favourably with many commercial samples examined in the laboratories. A more comprehensive study of the keeping properties of latex both in Ceylon and in this country is now being made.

A series of samples of latex prepared with different amounts of ammonia (from 0.56 to 1.64 per cent.) was also obtained from the Rubber Research Institute, Malaya and examined periodically after storage in London in their original containers. After twelve months all showed reduced stability. It is unlikely that this deterioration is due to bacterial action as the samples with the largest and least ammonia contents showed the same reduction in stability. The effect is more probably due to hydrolysis by ammonia of the natural protein stabilising agent in latex, in which case it is possible that eventually the sample containing the most ammonia will be the least stable.

The fact that the properties of ammonia preserved latex change appreciably on keeping is of considerable practical importance and emphasises the undesirability from a technical point of view of keeping latex in stock for more than a few months although of course it will retain its liquid condition for years.

3. CONCENTRATION.

(a) **Evaporation.**—An apparatus for the concentration of latex constructed by the staff in London was supplied to both the Rubber Research Institute of Malaya and the Ceylon Rubber Research Scheme for concentration trials. Both of these organisations confirm that it is possible to concentrate fresh latex in the apparatus without the aid of additional stabilising agents, the optimum concentration consistent with ease of handling, being in the region of 68 per cent. dry rubber content, but the general opinion is that the throughput of the apparatus is low and further loss of ammonia which takes place during the evaporation of the latex is a disadvantage. A new type of evaporator will be tested in London during the coming year.

(b) **Filtration.**—Promising results of concentrating latex by filtration on a small scale were obtained by the Rubber Research Institute, giving rise to a request that the London staff would make enquiries as to the possibility of obtaining suitable filtering media for latex. Considerable assistance was given by the well-known pottery firm, Messrs. Doulton & Co., who supplied a large variety of pottery ware for experimental purposes. It was found that the texture of the material suitable for the filtration of latex lay within a narrow range, and although it was possible to obtain fairly satisfactory results with a small apparatus, this was more difficult with larger apparatus. During the course of this work several mechanical devices were tried in order to prevent the formation of paste on the walls of the vessel, and also to increase the speed of filtration but these difficulties were not overcome completely. Two small consignments of latex concentrated by the filtration of creamed latex and by evaporation were received from the Rubber Research Institute, who had found the viscosity of the evaporated latex to be much higher than that of the filtered latex, although substantially of the same dry rubber content. On examination in London a comparatively greater difference in viscosity was observed. The removal of the serum during filtration produced a latex having a low content of non-rubber substances, being of the order of 2 per cent. based on the rubber. This has the effect of lowering the stability of the filtered latex in comparison with the evaporated latex. Such a latex would, however, doubtless have commercial possibilities if it could be produced on a large scale.

(c) **Creaming.**—The Rubber Research Institute has investigated the creaming action on latex of a number of dispersing agents, and has discovered that a cream having a high dry rubber content can be obtained with sulphonated lorol provided that a relatively high concentration of the creaming agent is used. The substance is ineffective in an alkaline medium

and despite the absence of ammonia or some similar substance the latex retains its stability for a considerable period. Tests on the latex in London confirmed that the retention of a large proportion of the sulphonated loral in the latex has a protective influence and imparts a high stability, and that the latex is not easy to coagulate, except with organic liquids. It also appears to prevent effective adhesion of the rubber particles when the water phase is removed. For these reasons it was considered that the latex would be unsuitable for the manufacture of many articles from latex. Its suitability for other uses has, however, been confirmed but the high cost of creaming places the material at a serious disadvantage.

A process for the removal of water soluble serum substances by the repeated creaming of latex is used commercially to obtain rubber suitable for the electrical industries. A sample of latex which had been creamed three times in Ceylon was examined in London and found to contain rather more nitrogen than that reported by other investigators. The difference is probably due to the fact indicated by experiments in London that old ammoniated latex can be more easily purified than fresh latex. The triple creamed latex may, nevertheless, be of satisfactory quality where low water absorption is required.

4. COLLOIDAL PROPERTIES.

(a) **Creaming Phenomena.**—Microscopic study of mixtures of latex and hydrophylic colloids showed that creaming agents have the distinctive property of aggregating the latex globules into clusters which are reversible on shaking the latex or on dilution of the creaming agent. The rate and degree of creaming was shown to be a function of the size of the clusters and the viscosity of the latex. Latex can be purified by repeated creaming and dilution with water but when it is creamed three or four times further creaming becomes difficult unless the latex is diluted to 30 per cent. concentration or less, and moreover, the dry rubber content of the concentrate at this stage seldom exceeds 50 per cent., apparently due to some property which makes it difficult to obtain close packing of the clusters. A sample of triple-creamed latex from Ceylon was creamed 14 times in London and apparently the process could have been repeated indefinitely. The dry rubber content of the concentrate was always less than 50 per cent. and the rubber from the purified latex still contained an appreciable amount of nitrogen, which could not be wholly due to the fact that the creaming agent employed contained some nitrogen. The cause of clustering, and the effect of repeated creaming on the chemical composition of latex and the packing of the clusters is to receive further attention.

(b) **Distribution of Non-rubber Substances.**—When latex is allowed to separate into two layers by creaming it is possible to calculate the amount of any non-rubber substance associated with the caoutchouc from a determination of the amount present in the skim and in the original latex. Preliminary investigations indicate that the nitrogenous substances associated with the caoutchouc are reduced by chemical interaction with ammonia and

that there is a marked decrease when latex is diluted to contain less than 10 per cent. dry rubber. Acetone soluble substances and their acid constituents are also reduced by dilution. Further studies are now being made to determine whether the association of caoutchouc and non-rubber substances follows an absorption law.

A few parallel studies on the treatment of latex with enzymes as a step in removing constituents which have a detrimental effect on rubber used for electrical purposes have shown that trypsin at 30°C. and papain at 60°C. are equally effective in reducing the amount of nitrogenous substances associated with caoutchouc. The experiments also indicated that a preliminary hydrolysis of proteins by either enzymes or alkalis is a desirable step in the preparation of rubber for use in the electrical industries.

RUBBER.

1. SOFTENED RUBBER.

Considerable interest has been displayed in recent years in the softening of rubber by hydrazine compounds and a series of samples was prepared in Malaya with the object of investigating the effect produced on the rubber by adding phenylhydrazine hydrochloride to latex.

The samples were examined in London and demonstrated that soft rubber could be prepared by adding phenylhydrazine derivatives to latex but the poisonous character of the softening agent employed would prevent its use on a large scale.

It is well known that on exposure to the action of direct sunlight rubber becomes soft and, as a matter of interest, samples were obtained from the Rubber Research Institute with a view to determining whether rubber softened by this means is different in quality from that of commercial "softened rubber" prepared by heating in air. The sun dried sheets were fairly uniform in colour but were sticky in places with varying plasticity values for different parts of the sheets. The rubber was not sufficiently soft to be classed as "softened" rubber, and gave consistently lower tensile strengths and had definitely poorer ageing properties than a control sample of sheet, suggesting that rubber softened by sunlight to the same extent as "softened rubber" would be inferior in quality.

2. "LOW WATER ABSORPTION" RUBBER.

Previous experimental samples prepared at the Rubber Research Institute of Malaya by the proteolytic decomposition of the protein having given promising results, a larger consignment was requested for distribution to manufacturers. The differences between the original small samples and the larger samples since received indicate that the method has features which may be difficult to control in practice. Simultaneously with the examination of the above samples, two samples prepared on the Goodyear estates in Sumatra, were also tested, opportunity being taken

to use the hot water immersion method which is preferred in the U.S.A. They had a very low nitrogen content and a correspondingly low water absorption value.

3. SYNTHETIC RUBBER — BUNA.

Buna is the name given to the rubber-like products obtained in Germany by the polymerisation of butadiene. A number of different grades are being marketed differing in degree and mode of polymerisation, and in physical and chemical characteristics, each grade being manufactured to suit the industrial purpose for which it is intended to be used. At the time of the investigation some difficulty was experienced in obtaining appreciable amounts of the different grades, but sufficient of three varieties was obtained for a preliminary chemical examination, which showed that the samples of Buna consisted of a complex mixture of substances and that in one case the polymerised butadiene did not exceed 50 per cent of the material.

Commercial supplies of Buna are now available and will be tested when opportunity occurs.

4. HALOGEN DERIVATIVES OF RUBBER FROM LATEX.

A description was given in the last report of the preparation and properties of partially halogenated derivatives of rubber from preserved latex. Samples prepared from fresh latex were subsequently received from the Rubber Research Institute and were under examination at the end of the year.

A method has now been devised for obtaining from preserved latex a more fully chlorinated rubber in the form of a white powder which is soluble in organic solvents. This appears to have similar properties to the chlorinated rubbers prepared from dry rubber which are used in varnish making.

ROAD SURFACING AND FLOORING MATERIALS.

1. LATEX CEMENT MIXTURES.

A more detailed study was made of the micro structure of latex cement mixtures, hydration processes involved during setting, methods of compounding and mechanical properties, which were referred to in the Report for 1937. Other investigations carried out were (a) a study of the effect of protective colloids and other substances on the properties of cement latex compositions and the development of formulae for practical mixtures, (b) a preliminary examination of the relation between cement latex binders and various aggregates, (c) a preliminary study of the technique of application of cement latex compositions as flooring, together with small scale practical trials (including the refacing of worn stone steps), (d) the development of a series of mechanical tests

to measure the physical characteristics of cement latex mixtures, (e) the comparison of various cement latex compositions with other flooring materials.

For practical processing it was found necessary to control (1) the period during which the mixture remained stable, (2) the viscosity, (3) the time required to set hard. This was found to be possible by using (1) stabilisers, such as casein, (2) materials which decrease viscosity, such as crystalline sodium silicate and those which increase it, such as well known compounding ingredients and (3) substances which accelerate the set of the cement, such as lime. The nature of the finished product was found to be partly dependent on the quantities of stabilisers and cement-set accelerators used; with excess stabiliser a soft product was generally obtained; with excess accelerator a hard cementitious material resulted. Delayed coagulants also gave rise to rubbery products. It was found that increased quantities of water caused a reduction both in the tensile and compressive strength, whereas an increase in the proportion of rubber gave rise to greater tensile strength, but reduced the compressive strength. Vulcanising ingredients appeared to exert no appreciable effect on the mechanical properties but were thought to confer improved resistance to ageing. A number of mixtures which were satisfactory for use as binders with aggregates were eventually devised, details of which were published in the *Journal of the Institution of the Rubber Industry*.

Trials were made with various types of aggregate which were found to have marked effects on the properties of the finished mixtures. Soft flexible aggregates such as cork, asbestos, shredded waste rubber and wood chips generally gave good adhesion to a flexible binder and hard aggregates such as granite, marble, gravel and crushed cement were more suitable for use with a hard binder. In order to obtain mixtures which could be trowelled to a smooth finish it was necessary to use an aggregate with controlled proportions of different particle sizes.

During a discussion of the work with the Building Research Station it was pointed out that physical tests were necessary to obtain standards which would enable users to specify the quality required and also to compare the properties of cement latex mixtures with those of well known flooring materials with which they would have to compete. A comprehensive series of tests was, therefore, drawn up in co-operation with the Building Research Station and so far the following have been developed; (1) tensile and compressive strength, (2) hardness, (3) coefficient of restitution, (4) water absorption, (5) contraction during setting and (6) ageing properties. Machine for determining tensile strength and coefficient of restitution had previously been constructed; a machine for measuring compressive strength which gives an autographic record of the stress strain relationship during compression has since been built in the departmental workshops. Arrangements were also made for abrasion tests to be carried out in co-operation with Professor R. G. H. Clements in the Highways Laboratory of the City and Guilds (Eng.) College.

The results of the various tests show that commercial cement latex mixtures possess properties similar to those of other flooring materials with the important advantage that their resilience can be increased to a value exceeding that of any other flooring material not containing rubber. The range in properties of the mixture is very wide and by making simple adjustments in composition it is possible to obtain material nearly as hard as cement or softer than asphalt.

2. RUBBER ASPHALT MIXTURES.

Preliminary work carried out in previous years showed that in some circumstances the addition of rubber to bitumen improved its properties and it was therefore considered desirable to make a detailed laboratory study of the subject. In this connection an investigation was made during the year of the effect of rubber on the properties of five typical classes of bitumen, viz., (1) a straight-run asphaltic bitumen, (2) a straight-run asphaltic bitumen in combination with Lake Asphalt, (3) "oily" bitumen, (4) a blown bitumen, and (5) an oil-fluxed Lake Asphalt. The best mixtures for the purpose of highway surfacing appeared to be those containing a proportion of blown bitumen. This is particularly interesting as, in non-rubber work, the use of any appreciable proportion of blown bitumen is regarded as unsound owing to the low ductility of the latter material and its general brittleness at low temperatures. When, however, the blown bitumen is blended with both straight-run bitumen and rubber, these disadvantages disappear and an extremely tough mixture results, having a good ductility over a wide temperature range.

Experience with highway surfacing trials has indicated that there is little apparent difference between a freshly laid bitumen carpet containing rubber and one without, but in the course of time it is observed that there appears to be less tendency for the surface containing rubber to "flush-up" and become smooth. These surfaces should, therefore retain their non-skid characteristics for a longer period than a bitumen surface without rubber. The "flushing-up" of bitumen is due to its flow properties, and rubber is more likely to receive favourable consideration, therefore, because of its effect on flow properties of bitumen than for any other reason.

In March it was decided to embark upon a more detailed study of the flow properties of rubber/bitumen mixtures, and an extensive programme of work was drawn up. A special viscometer of the rotating cylinder type was constructed in order to determine the absolute viscosity of the materials over a wide range of atmospheric temperatures. From the results so far obtained it is apparent that none of the materials examined to date behaves as a true fluid. The departure from Newtonian laws appears to depend upon the rate at which the material is displaced. This makes the whole research extremely complicated, but gradually a complete picture is being prepared of the flow properties of bitumens with varying properties of rubber incorporated over a wide range of conditions. Earlier views are confirmed concerning the value of small proportions of rubber in reducing the flow tendency of bitumens.

In addition to the laboratory work, the rubber/asphalt research was continued on a practical scale by the laying of eight further sections of road at Poole. These embrace mixtures embodying rubber in latex and crumb form, and recent inspections show that so far the trials are successful and there is every prospect that they will maintain their "non-skid" surface over a long period. At the close of the year arrangements were in hand for the laying of further trial sections in the London area during 1938. It is also of interest to note that the original section laid at Poole, Dorset, in 1935 is still in excellent condition.

G. MARTIN,

Superintendent of Rubber Investigations.

Imperial Institute,

April 28th, 1938.

AUDITOR GENERAL'S REPORT FOR 1937.

The Chairman,
Board of Management,
Rubber Research Scheme,
Peradeniya.

Sir,

I have the honour to report that the audit of the accounts of the Rubber Research Scheme for the year, 1937, has been completed and have pleasure in forwarding the following documents duly certified:—

- (a) Dartonfield Estate Working Account for the year, 1937.
- (b) Nivitigalakele Experiment Station Working Account for the year, 1937.
- (c) Trading Account of Vulcanized Rubber Products for the period 1st July to 31st December, 1937.
- (d) Income and Expenditure Account for the year, 1937.
- (e) Capital Account and General Balance Sheet as at December 31, 1937.
- (f) Statement of Receipts and Payments of Officers' Provident Fund for 1937.

I. INCOME.

2. The total income which accrued during the year amounted to Rs. 230,490. It exceeded the estimate of Rs. 163,760 by Rs. 66,730 and the income of the previous year by Rs. 52,804.

3. The following is a comparison between the estimate and the actual income under the different accounts for the year under review:—

Account	Estimated Rs.	Actual Rs.	Excess Rs.
1. Cess Collections	147,420	191,985	44,565
2. Interest	2,000	4,125	2,125
3. Sale of Publications	400	819	419
4. Profit from Dartonfield Estate	12,500	25,615	13,115
5. Profit from Nivitigalakele Experiment Station	440	6,287	5,847
6. Sundry Receipts	1,000	1,659	659
	<u>163,760</u>	<u>230,490</u>	<u>66,730</u>

4. The reasons for the increases under the different accounts are as follows:—

1. Due to increased exports of rubber during the year.
2. Due to better yields from the investment of cash balances.
3. Under-estimate.
- 4 and 5. Due to the prevalence of a better market for rubber than anticipated.
6. Due to the charges recovered from the Staff for electricity supplied being credited to this account.

5. **Profit from Dartonfield Estate.**—The details of the expenditure incurred and the revenue earned from the Dartonfield Estate are set forth in the Working Account of the estate. The profit earned for the year under review is below that earned for 1936 by Rs. 650.

6. **Profit from Nivitigalakele Experiment Station.**—The working of the Experiment Station for the year showed a profit of Rs. 6,287 as compared with the profit of Rs. 5,780 earned during the previous year. The details of the income earned and the expenditure incurred are set forth in the Estate Working Account.

The expenditure charged against the income from the Experiment Station includes a sum of Rs. 85/- incurred on the course of instruction in budgrafting conducted under the auspices of the Scheme. As the vote for this expenditure is included under the Experiment Station in the sanctioned estimates, this sum is charged to the income of the Station although it is not properly chargeable thereto. The profit exclusive of this expenditure is Rs. 6,372.

II. EXPENDITURE.

7. **Revenue Expenditure.**—The total expenditure on Revenue Account exclusive of the amounts allowed for depreciation of fixed assets, the Passage and Audit Fee Reserves and the loss on the sale of certain fixed assets amounted to Rs. 116,699 as compared with Rs. 114,641 of the previous year. The details of this expenditure are fully set forth in the Income and Expenditure Account. The whole of this expenditure was checked with supporting vouchers and accounts.

8. **Capital Account.**—The expenditure incurred on fixed Capital Assets during the year amounted to Rs. 79,571. The details of this expenditure are as follows:—

			Rs.	cts.
Land including Development:—				
Dartonfield	...	...	3,271	94
Nivitigalakele	...	...	6,325	53
Building and Lines:—				
Dartonfield—Estate	...	...	3,015	89
Headquarters	...	...	33,643	75
Nivitigalakele—Headquarters	...	...	14,075	14
Furniture and Fixed Equipment:—				
Dartonfield	...	...	5,735	05
Nivitigalakele	...	...	608	90

			Rs. cts.
Water and Power Supply :—			
Dartonfield	...	...	7,735 27
Nivitigalakele	...	...	469 67
Machinery and Tools :—			
Dartonfield	...	...	3,416 16
Laboratory Apparatus	...	...	1,273 69
			<u>79,570 99</u>

9. The following is a comparison between the original estimate and the expenditure incurred in respect of the year under review :—

Account		Estimated	Actual	Excess	Supple- mentary Provision	Saving
I. Personal Emoluments.—						
		Rs.	Rs.	Rs.	Rs.	Rs.
1-5	Salaries of Technical Officers	55,658	54,872	—	—	786
6	Salary of Secretary to Director	3,000	3,000	—	—	—
7-14	Salaries of Sub-Ordinate Staff	10,055	9,754	—	—	301
15	Rent Allowances	264	574	310	270	—
16	Provident Fund Contribution	4,630	4,658	28	—	—
II. Other Charges.—						
17a	Laboratory upkeep	3,000	3,872	872	302	—
17b	Samples for London Experiments	50	—	—	—	50
17e	Upkeep of Experimentntal Machinery	1,000	592	—	—	408
18a	Upkeep of Buildings	200	478	278	200	—
18b	Insurance	700	471	—	—	229
18c	Upkeep of Water Supply	100	371	271	250	—
18e	Furniture Replacements	50	50	—	—	—
19a	Printing and Advertising	1,250	2,974	1,724	—	—
19b	Stationery	2,350	2,577	227	—	—
19c	Postages	1,700	1,713	13	—	—
19d	Books and Periodicals	600	831	231	400	169
19e	General Charges	750	685	—	—	65

Account		Estimated	Actual	Excess	Supple- mentary Provision	Saving
		Rs.	Rs.	Rs.	Rs.	Rs.
19f	Audit and Accountancy	550	1,182	632	32	—
19g	Telephones	1,000	1,408	408	425	17
20a	Travelling of Staff	3,000	2,884	—	—	116
20b	Travelling of Board Members	1,250	1,765	515	500	—
22	London Advisory Committee's Expenditure	12,000	11,596	—	—	404
23	Passage Reserve	1,250	1,250	—	—	—
24	Depreciation	18,000	18,298	298	—	—
25	Dartonfield Experiments	9,693	10,424	731	—	—
26	Smallholdings Work	3,932	2,138	—	—	1,794

III. Capital Expenditure.—

A	Director's Bungalow	20,000	19,924	—	1,000	1,076
B	Smallholdings Propaganda Officers' Bungalow	17,000	14,052	—	850	3,798
C	Bungalow of Secretary to Director	10,000	9,826	—	500	674
D	Junior Staff Bungalows	9,000	6,851	1,783	6,492	8,641
E	Estate Office	2,500	3,272	772	1,500	728
F	Water and Power Scheme	—	3,233	3,233	3,352	119
G	Experimental Machinery	2,000	3,412	1,412	8,750	7,338
H	Dartonfield Upkeep of Immature areas	992	1,254	262	—	—
I	Bridge to No. 5 Field	130	—	—	—	130
J	Nivitigalakele Agricul- tural Development	9,226	8,408	—	33	851

IV. Re-votes.—

A	Main Laboratory Extension	3,618	3,734	116	—	—
B	Senior Staff Bungalow	1,347	981	—	—	366
C	Chief Clerk's Bungalow	946	329	—	—	617

Account	Estimated	Actual	Excess	Supple- mentary Provision	Saving
	Rs.	Rs.	Rs.	Rs.	Rs.
D Botanical Laboratory					
Apparatus	3,000	293	—	—	2,707
E Botanical Laboratory	582	736	154	154	—
F Estate Cart Road	418	1,107	689	610	—
G Fencing	144	109	—	—	35
H Minor Buildings	144	165	21	—	—
I Nivitigalakele Cart Road	2,600	1,533	—	—	1,067

10. The explanations for the major variations as furnished by the Director of Research are as follows:—

Savings.—

- I. 1-5. Absence of an officer on leave without pay.
- 7-14. Temporary vacancy in Staff.
- II. 17e. Over-estimate.
- 18b. Payment of Premia for 1937 on certain buildings in 1936.
- 19d. Payment for binding Periodicals not completed.
- 22. Saving on exchange.
- 26. Suspension of work for three months.
- III. A-C. Payments not completed.
- D. Work not completed.
- E. Materials from Culloden Laboratories re-used.
- F & G. Work not completed.
- I. Work not undertaken owing to delay in obtaining permit.
- J. Due to economies.
- IV. B. Furniture for one bungalow not completed.
- C. Payments not completed.
- D. Awaiting appointment of Geneticist.
- I. Work not completed owing to delay in acquiring land.

Excesses.—

- 11. 17a. Upkeep of Laboratory Grounds was paid from this vote.
- 19a. Heavy expenditure on advertisements of staff vacancies. Larger circulation of publications and lower revenue from advertisements than anticipated.
- 19b. Under-estimate.
- 19f. Includes Rs. 600 reserved for 1937 fees.
- 24. Due to increase of fixed assets.
- 25. Under-estimate.
- III H. Change in weeding policy.

11 The excesses under the different items except the following have been sanctioned by the Board:—

		Rs.
I.	15. Rent Allowances	40
	16. Provident Fund Contribution	28
II.	17a. Laboratory Upkeep, Chemicals and Apparatus	570
	18a. Upkeep of buildings	78
	18c. Upkeep of Water Supply	21
	19a. Printing and Advertising	1,724
	19b. Stationery	227
	19c. Postages	13
	19f. Audit and Accountancy	600
	20b. Travelling Expenses of Board Members ...	15
	24. Depreciation	298
	25. Dartonfield Experiment Account	731
III.	H. Dartonfield upkeep of immature areas ...	262
IV.	A. Dartonfield main laboratory extension ...	116
	F. Dartonfield cart road	79
	H. Dartonfield minor buildings	21
	Nivitigalakele 1936 Nursery	393
	Wagolla School Farm	85
	Loss on Culloden Building sold	4,000
	Loss on sulphur dusting machine sold	77

12. **Wagolla School Farm.**—The expenditure incurred on this account amounted to Rs. 515. It exceeded the estimate of Rs. 430 by Rs. 85. The income therefrom fell below the estimate by Rs. 49 chiefly owing to the proceeds of the sales of rubber produced on the Farm not being credited to this account.

13. **Manufacture of Vulcanised Rubber Products.**—A Trading Account showing the cost of manufacture and the income from the sales of the Vulcanised Rubber Products is attached to this Report. The undertaking which was started in July, 1937, has resulted in a net loss of Rs. 77 which is charged to the Revenue Expenditure for the year under review. The depreciation on the plant has not been charged to this account.

14. **Sale of Fixed Assets.**—The loss on the sale of the building at Culloden Estate which stood at a value of Rs. 5,500 in the books of the Scheme amounted to Rs. 4,000. This sum, together with the loss on the sulphur dusting machine sold during the year amounting in all to Rs. 4,077 is charged to the income for the year under review.

III. CAPITAL ACCOUNT.

15. The cost of fixed assets at December 31, 1936, stood at Rs. 546,040. The expenditure incurred on capital account during the year amounted to Rs. 79,570 and value of fixed assets sold during the year amounted to Rs. 6,452 leaving the value of the remaining assets at Rs. 619,158. The details of this amount are set forth in the Capital Account. The unappropriated surplus at December 31st, 1937, was Rs. 170,914.

IV. BALANCE SHEET.

(a) Liabilities.

16. **Creditors — Rs. 15,004.**—Of this amount, a sum of Rs. 14,801 represents the total amount due to creditors for goods purchased or services received in respect of the year and Rs. 203, the amount received in advance for the supply of budwood.

17. **Passage Fund Reserve — Rs. 5,596.**—During the year a sum of Rs. 871 was paid out from this fund to meet the cost of a passage home to a member of the staff who went on furlough. The contribution to the fund from the revenue of the year under review was the same as in the previous year, namely, Rs. 1,250.

18. **Depreciation Reserve — Rs. 55,311.**—This sum represents the amount set apart for the depreciation of the fixed assets of the Scheme. During the year, a sum of Rs. 826 representing the amount set apart in respect of apparatus sold was written off. The amount transferred from revenue to this account during the year was Rs. 18,298 made up as follows:—

Buildings and Lines.—

				Rs.	cts.
Dartonfield at 4% on	Rs. 150,731-17	...	...	6,029	25
Nivitigalakele at 4% on	Rs. 27,198-15	...	...	1,087	93

Furniture and Fixed Equipment.—

Dartonfield at $7\frac{1}{2}\%$ on	Rs. 18,369-49	...	...	1,377	71
Nivitigalakele at $7\frac{1}{2}\%$ on	Rs. 608-54	...	...	51	04

Machinery and Tools.—

Dartonfield at $7\frac{1}{2}\%$ on	Rs. 75,835-06	...	...	5,687	63
Nivitigalakele at $7\frac{1}{2}\%$ on	Rs. 105-50	...	...	7	91

Water and Power Supply.—

Dartonfield at $7\frac{1}{2}\%$ on	Rs. 21,705-41	...	...	1,627	90
Nivitigalakele at $7\frac{1}{2}\%$ on	Rs. 123-15	...	...	9	24
Laboratory Apparatus at 25% on	Rs. 9,678-52	...	...	2,419	63

Rs. 18,298 24

19. **Provident Fund Reserve — Rs. 31,091.**—The particulars of the receipts and payments on this account are shown in the Provident Fund Account to this Report. The balance standing to the credit of this fund at the beginning of the year was Rs. 23,848. The contributions by the staff during the year amounted to Rs. 3,669 and those made from the funds of the Scheme amounted to Rs. 4,657. Of the amount contributed by the Scheme, a sum of Rs. 3,644 represents the bonus equivalent to the sum contributed by the present staff during 1936, and Rs. 983 the interest due on the balance of the fund for 1937.

20. **Audit Fee Reserve — Rs. 600.**—This amount represents the estimated cost of audit payable in respect of the year under review charged to the income of the year on the directions of the Board of Management. The actual cost of the audit for the year is Rs. 595-72.

21. **Surplus Account — Rs. 170,914.**—This amount represents the accumulated cash surplus of the Scheme at December 31, 1937. The cash surplus at the commencement of the year was Rs. 154,467. The excess of income over expenditure for the year was Rs. 89,566. The net capital expenditure incurred during the year was Rs. 73,119. There was, therefore, a cash surplus for the year amounting to Rs. 16,447 which increased the total cash surplus at the close of the year to Rs. 170,914.

(b) **Assets.**

22. **Debtors — Rs. 22,964.**—Of this amount, a sum of Rs. 17,048 represents the amount due from the Deputy Financial Secretary on account of cess collections made during December, 1937. This amount was received from him in January, 1938. The balance, Rs. 5,915 was due from various persons in respect of produce, etc., sold and labour lent.

23. **Advance Account — Rs. 1,583.**—The details of the items making up the balance on this account are given in the balance sheet. The advances to the Superintendent of the estate and the Smallholdings Propaganda Officer were for sundry expenses and the amount shown against the Postmaster General represents the amount deposited with him in respect of trunk calls and other telephone fees.

24. **Accrued Interest on Investments — Rs. 2,808.**—This sum represents the amount of interest accrued for the year on the investments of the cash balances but not received.

25. **Payments in Advance — Rs. 122.**—This sum represents the amount paid during 1937 as subscription charges and fees for publications in 1938.

26. **Stock in Trade — Rs. 1,726.**—Of this amount, a sum of Rs. 1,204 represents the value of raw materials and finished vulcanised rubber products; Rs. 79 the value of the balance of rice in hand and Rs. 443 the value of other stock.

27. **Cash Balances — Rs. 249,313.**—The investment of Rs. 25,000 in the Ceylon Government $3\frac{1}{2}$ per cent. Loan, 1937-62 was verified by reference to the Stock Certificate. One of the fixed deposits amounting to Rs. 25,000 which matured on December 31, 1937, has since been transferred to the current account. The receipts in support of the balance with the exception of one receipt for Rs. 50,000 which had been sent to the bank for renewal were verified. The balances in the current account in the National Bank of India, Limited, Colombo, were verified by reference to the bank certificates. The balance of cash in hand at December 31, 1937, was not verified but a surprise verification of the cash in hand was made on February 24, 1938.

GENERAL.

28. The accounts were received quarterly and examined in this office. A departmental verification of all the inventory articles was held and a report forwarded to this office. The office of the Board was visited once during the year and the books and accounts kept were checked and the cash in hand verified.

I am, Sir,

Your Obedient Servant,

O. E. GOONETILLEKE,

Auditor-General.

Audit Office,

Colombo, March 15, 1938.

RUBBER RESEARCH SCHEME (CEYLON)

Revenue Account for the Year ended 31st December, 1937.

DR.					CR.
	Rs. cts.	Rs. cts.		Rs. cts.	Rs. cts.
To Personal Emoluments :—			By Balances from Estate		
Salaries of Technical Officers	54,872 66		Working Accounts :—		
Salary of Secretary to the Director	3,000 00		Dartonfield	25,614 58	
Salaries of Sub-ordinate Staff	9,754 47		Nivitigalakele	6,287 37	31,901 95
Rent Allowances	573 51		Cess Collections	...	191,984 89
Provident Fund Contribution	4,657 57		Interest	...	4,125 49
		72,858 21	Sale of Publications	...	818 51
Other Charges :—			Sundry Receipts	...	1,659 34
Laboratory :—					
Upkeep of Laboratory, Chemicals and Apparatus	2,597 68				
Upkeep of Experimental Machinery	592 33	3,190 01			
Buildings :—					
Upkeep of Buildings	478 09				
Insurance	471 09				
Upkeep of Water and Power Supply	371 35				
Furniture replacements	49 83	1,370 36			
Office :—					
Printing and Advertising	2,973 59				
Stationery	1,701 85				
Postages	1,713 13				
Books & Periodicals	831 21				
General Charges	684 66				
Audit & Accountancy	1,182 37				
Telephones	1,408 25	10,495 06			
Travelling :—					
Travelling expenses of Staff	2,883 70				
Travelling expenses of Board members	1,765 00	4,648 70			
London Advisory Committee's Expenditure	...	11,596 26			
Contribution to Passage Fund Reserve	...	1,250 00			
Dartonfield Estate Experimental Account	...	10,423 63			
Smallholdings Work	...	2,137 82			
Entertainment Allowance	...	167 50			
Manufacture of Vulcanised Goods :—					
Balance from trading account	...	77 47			
Wagolla School Farm :—					
Expenditure	514 82				
Less Income	180 55	334 27			
Depreciation	...	18,298 24			
Loss on Sale of Capital Assets :—					
Culloden Buildings	4,000 00				
Laboratory Apparatus	77 13	4,077 13			
Balance, being excess of Income over Expenditure for the year		89,565 52			
		<u>Rs. 230,490 18</u>			<u>Rs. 230,490 18</u>

Working Account for the Year Ended 31st December, 1937.

Dartonfield Estate.

	Rs. cts.	Rs. cts.		Rs. cts.
To Expenditure :—			By Sale of Rubber (78,020 lbs.) and coupons	...
General Charges	4,864 70			41,992 43
Upkeep	565 90			
Cultivation	1,856 70			
Collection	3,812 95			
Manufacture	3,997 72			
Distribution	1,279 88	16,377 85		
Balance transferred to Revenue Account		25,614 58		
		<u>Rs. 41,992 43</u>		<u>Rs. 41,992 43</u>

Nivitigalakele Experiment Station.

	Rs. cts.	Rs. cts.		Rs. cts.	Rs. cts.
To Expenditure :—			By Sale of Produce :—		
General Charges	1,545 30		Rubber (13,380 lbs.) and coupons	8,027 30	
Revenue Account	2,037 14		Planting material	4,041 32	
Upkeep of Pinnagoda Nurseries	1,565 30		Cover crop seed	107 02	12,175 64
Collection and Distribution of Budwood	740 53	5,888 27			
Balance transferred to Revenue Account		6,287 37			
		<u>Rs. 12,175 64</u>			<u>Rs. 12,175 64</u>

Manufacture of Vulcanised Products

Trading Account for the Period 1st July to 31st December, 1937.

	Rs. cts.	Rs. cts.		Rs. cts.	Rs. cts.
To Value of Stock on July 1, 1937 :—			By Sales		
Raw materials	396 60		Stock at December 31, 1937 :—		670 73
Finished goods	9 93	406 53	Raw materials	873 89	
Purchase of raw materials		763 40	Finished goods	330 49	1,204 38
Wages	...	286 75	Balance transferred to Revenue Account	...	77 47
Fuel	...	208 56			
Duty, landing and clearing charges and transport on raw materials	...	139 41			
Other Charges	...	147 93			
		<u>Rs. 1,952 58</u>			<u>Rs. 1,952 58</u>

RUBBER RESEARCH SCHEME (CEYLON)

Capital Account as at 31st December, 1937.

DR.						CR.	
EXPENDITURE.						RECEIPTS.	
To December 31, 1936	Transfers between accounts.	Additions in 1937.	Deduct Cost of Assets sold or scrapped in 1937.	Total	By Revenue applied to capital purposes:—	Rs. cts.	Rs. cts.
Rs. cts.	Rs. cts.	Rs. cts.	Rs. cts.	Rs. cts.	December 31, 1936. In 1937	...	...
To Land, including Development:—					Surplus Funds:	154,466 82	
Dartonfield	—	3,271 94	—	104,865 71	December 31, 1936.	...	546,039 68
Nivitigalakele	—	6,325 53	—	96,389 82	Revenue Account Surplus 1937	89,565 52	73,118 61
Buildings and Lines:—					Less Contribution to capital outlay	73,118 61	619,158 29
Dartonfield:—						16,446 91	170,913 73
Estate	—	3,015 89	—	33,793 83			
Headquarters	—	33,643 75	—	158,995 56			
Culloden	—	—	5,500 00	—			
Nivitigalakele:—							
Estate	28,295 63	Cr. 583 00	—	27,712 63			
Headquarters	—	—	14,075 14	14,075 14			
Furniture and Fixed Equipment:—							
Dartonfield	22,600 78	Cr. 480 50	5,735 05	27,855 33			
Nivitigalakele	—	2,563 50	608 90	3,172 40			
Culloden	1,500 00	Cr. 1,500 00	—	—			
Water and Power Supply:—							
Dartonfield	22,399 16	—	7,735 27	30,074 43			
Nivitigalakele	123 15	—	469 67	592 82			
Machinery and Tools:—							
Dartonfield	85,460 72	—	3,416 16	88,876 88			
Nivitigalakele	105 50	—	—	105 50			
Laboratory Apparatus	21,053 59	—	1,273 69	21,374 90			
London Plant	11,333 34	—	—	11,333 34			
Unappropriated Surplus	546,039 68	—	79,570 99	619,158 29			
	154,466 82	—	16,446 91	170,913 73			
	700,506 50	—	96,017 90	6,452 38			Rs. 790,072 02

General Balance Sheet as at December 31, 1937.

DR.				CR.	
LIABILITIES.				ASSETS.	
		Rs. cts.	Rs. cts.		Rs. cts. Rs. cts.
Creditors:—				Debtors:—	
Sundries	...	14,801 49		Cess collections for December, 1937.	17,048 35
Deposit for supply of budwood	...	202 55	15,004 04	Sundries	5,915 19
Passage Fund Reserve:—					22,963 54
At December 31, 1936	...	5,217 04		Advance Accounts:—	
Add Reserve for 1937	...	1,250 00		London Advisory Committee	1,132 46
	...	6,467 04		Estate Superintendent:—	
Less Payments in 1937	...	870 69	5,596 35	Dartonfield	109 34
				Nivitigalakele	167 57
Depreciation Reserve:—				Wagolla	12 35
At December 31, 1936	...	37,837 96			289 26
Add Reserve for 1937	...	18,298 24		Smallholdings Propaganda Officer	65 29
	...	56,136 20		Postmaster-General	95 00
Less Depreciation on apparatus sold	...	825 25	55,310 95	Officer-in-charge, Peradeniya Experiment Station	0 50
					1,582 51
Provident Fund Reserve:—				Accrued Interest on Investments	2,807 83
At December 31, 1936	...	23,847 89		Payments in advance	121 89
Add Reserve for 1937	...	7,242 77		Stock-in-trade	1,726 48
	...	—	31,090 66	Cash Balances:—	
Audit Fee Reserve	...	—	600 00	Investments in Ceylon Government 3½% Loan	25,000 00
Surplus Account:—				On fixed deposits	155,000 00
At December 31, 1936	...	154,466 82		On Current Account No. 1	68,432 45
Add excess of Income over Expenditure, 1937	...	89,565 52		On Current Account No. 2	737 19
	...	244,032 34		In hand	143 84
Less Contribution to Capital Outlay	...	73,118 61	170,913 73		249,313 48
			Rs. 278,515 73		Rs. 278,515 73

I certify that the above Balance Sheet presents a true and correct view of the financial affairs of the Rubber Research Scheme (Ceylon) as shown by the books on December 31, 1937.

(Sgd.) O. E. GOONETILLEKE,
Auditor-General.

Audit Office,
Colombo, 15th March, 1938.

(Sgd.) E. RODRIGO,
Chairman,
Board of Management,
Rubber Research Scheme (Ceylon).

PROVIDENT FUND.

Working Account for the Year Ended 31st December, 1937.

DR.				CR.	
		Rs. cts.		Rs. cts.	Rs. cts.
To Payments to retiring members	...	1,083 90	By Balance brought forward from 1936	...	23,847 89
Balance carried forward to 1938	...	31,090 66	Board's contribution for 1936:—		
			Bonus	3,643 67	
			Interest on Contributions	533 11	
			Interest on bonus	451 59	
				4,628 37	
			Less interest over-credited in 1936	1 50	
					4,626 87
			Members' Contributions in 1937	...	3,669 10
			Bonus and interest for 1937 paid to two retiring members	...	30 70
					Rs. 32,174 56

Audited and found correct:

(Sgd.) O. E. GOONETILLEKE,
Auditor-General

Audit Office,
Colombo, 15th March, 1938.

(Sgd.) E. RODRIGO,
Chairman,
Board of Management,
Rubber Research Scheme (Ceylon).

ESTIMATES FOR 1938.

(REVISED)

(Adopted by the Board, March 24th, 1938)

REVENUE

				Rs. cts.
1.	Cess Collections	...	...	144,373 00
2.	Interest	...	...	3,500 00
3.	Sale of Publications	..	...	400 00
4.	Profit from Dartonfield	...	...	9,873 00
5.	Profit from Nivitigalakele	...	...	2,632 00
6.	Sundry Receipts	...	...	2,200 00
				...
				Rs. 162,978 00

REVENUE EXPENDITURE

	Rs. cts.	Rs. cts.
1. Administration of the Board:—		
Travelling expenses of members		1,750 00
2. Personal Emoluments:—		
Senior Scientific Staff ...	59,896 00	
Junior Scientific Staff ...	4,031 00	63,927 00
3. Library and Publications:—		
Library ...	1,000 00	
Publications ...	2,000 00	3,000 00
4. Smallholdings Work:—		
Salaries and allowances ...	14,438 00	
Travelling and General Expenditure	7,145 00	21,583 00
5. Laboratory:—		
Equipment and Working Expenses	4,000 00	
Furniture replacements	50 00	4,050 00
6. Field and Factory Experiments:—		
Field Experiments ...	4,261 00	
Factory Experiments	1,486 00	
Budding Instruction	1,132 00	6,879 00
7. Office:—		
Salaries of Office Staff ...	8,147 00	
Stationery and Office Equipment	2,000 00	
Postages and Telegrams ...	1,700 00	
Advertising	250 00	
Telephones	1,150 00	
Audit	600 00	13,847 00
8. Travelling of Staff ...	...	4,000 00
9. Maintenance of Buildings.		
Laboratory and Offices	187 00	
Bungalows ...	863 00	
Water and Power Supply ...	262 00	1,312 00
	Carried over	120,348 00

	Rs. cts.	Rs. cts.
Brought forward		120,348 00

10. **Miscellaneous Items Shared with Estate:—**

Dartonfield General Charges ...	5,366 00	
Nivitigalakele General Charges	1,665 00	
Upkeep of Roads and Grounds	405 00	
Factory Upkeep ...	387 00	
Power Supply ...	<u>2,262 00</u>	10,085 00

11. **Contingencies:—**

Contribution to London Advisory Committee ...	12,000 00	
General Charges ...	750 00	
Insurances ...	850 00	
Staff Provident Fund ...	5,100 00	
Passages ...	1,000 00	
Entertainment Allowance ...	<u>300 00</u>	20,000 00

12. **Depreciation**

...	..	21,500 00
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<u>Rs. 171,933 00</u>

CAPITAL EXPENDITURE

	Rs. cts.	Rs. cts.
Buildings, etc.—		
<i>Dartonfield :—</i>		
1 Senior Staff Bungalow ...	18,500 00	
Water and Power Scheme ...	753 00	
Cart Road ...	185 00	
Factory Store and Improvement of Tool Store ...	800 00	
<i>Nivitigalakele :—</i>		
Field Laboratory for Geneticist	2,000 00	
1 Junior Staff Bungalow ...	3,500 00	25,738 00
Equipment :—		
Apparatus for Soil Chemist ...	3,000 00	
Specimen Cases for Botanical Laboratory ...	240 00	
Book Cases for Library ...	450 00	
Shelving for Record Room ...	300 00	3,990 00
Immature Areas :—		
Dartonfield ...	2,605 00	
Nivitigalakele ...	940 00	3,545 00
		<u>Rs. 33,273 00</u>

SUMMARY.

	Rs. cts.	Rs. cts.
Income ...		162,978 00
Expenditure :—		
Revenue ...	171,933 00	
Capital ...	33,273 00	
Revotes of 1937 Capital Items	27,733 00	232,939 00
Excess of Expenditure over Income		<u>Rs. 69,961 00</u>

